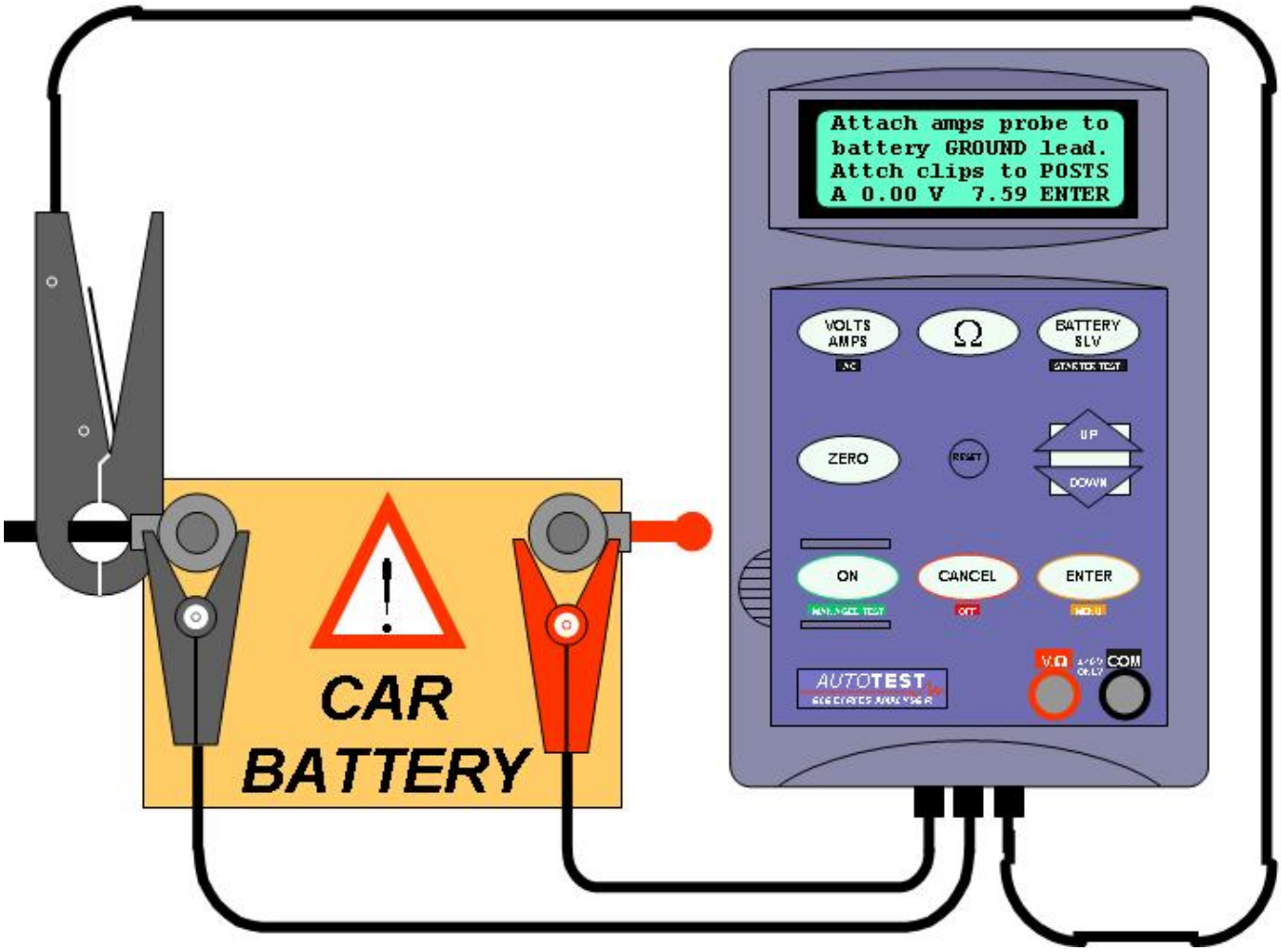
AUTOTEST
USER MANUAL 2.0



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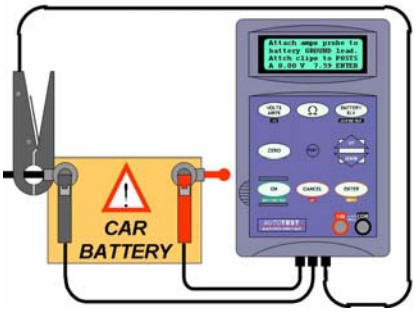
1. Introduction



AutoTest is a hand held measuring instrument designed for use in analyzing 12-volt automotive electrical systems. It is a microprocessor controlled device that can be used as a:

- Stand alone automotive battery tester.
- Battery load tester/starter motor tester. By using the vehicle starting system as a constant current electrical load for the battery, AutoTest can perform a traditional battery load test. The results can also be used to analyze the starter motor condition.
- Full featured automotive multimeter.
- Current probe.
- Electrical system analyzer that prompts the operator through a comprehensive vehicle electrical system test via messages on its 4-line liquid crystal display.

2. AutoTest Essentials

2.1. Safety First

Sparks, flames and cigarettes can ignite the gas emitted by vehicle batteries. It is important to always follow the following safety guidelines when working with automotive electrical systems:

- Minimize sparking when connecting and disconnecting test leads by connecting the *negative* test clip first (before connecting the positive test clip), and disconnecting it last (after disconnecting the positive test clip).
- Only test and charge vehicle batteries in well-ventilated areas.
- Wear eye protection whenever working with vehicle batteries.

2.2. Excessive Voltages

AVOID EXCESSIVE VOLTAGES. AutoTest is an automotive meter that is capable of measuring voltages in the range of ± 40 Volts. It is not suitable for checking household voltages such as 240 Volts or 110 Volts. Exposure of AutoTest to 240 Volt or 110 Volt sources could cause serious damage to AutoTest's circuitry and may result in personal injury.

Care should be taken to avoid exposure of AutoTest to other excessive voltages such as those found on the ignition high-tension leads. Under no circumstances should the current probe be placed around a spark plug lead. Exposure of AutoTest to high-tension voltages that are found in a vehicle's ignition system could cause serious damage to AutoTest's circuitry and may result in personal injury.

2.3. Assumption: Negative Earth

This manual is written assuming that the vehicle being tested has a negative-earth electrical system.

If this is not the case — that is, if the vehicle's chassis/earth is connected to the positive of the battery (as in some older cars, for example) — simply substitute "positive" for "negative" and "negative" for "positive" wherever they occur in this manual.

2.4. Electrolyte Level

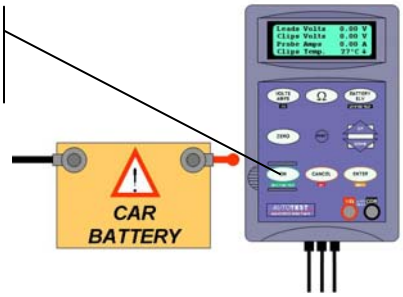
In the case of batteries with vent plugs or removable inspection covers, always check that the electrolyte level is at the top of the separators in each cell before using AutoTest to analyse the vehicle's electrical system.

If you use AutoTest to test a battery with low electrolyte levels — or you *suspect* them to be low — AutoTest's Reject or Marginal decisions (reported in the Managed or Battery SLV tests) may be unreliable. AutoTest can only reliably analyze a battery once the electrolyte has been topped-up to the correct level and the battery has been allowed to chemically "settle". After charging or discharging it will take between 20 minutes to 1 hour for a battery to chemically stabilize to the point where reliable battery condition readings can be made.

2.5. Button Pressure

When pressing AutoTest's front panel buttons, be sure to use deliberate and firm pressure so that you feel the button click. The screen will change immediately to confirm your press.

2.6. How to Turn the AutoTest ON

Directions	Screen and Explanations
Press the "ON" button to turn the tester "ON". 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C** This screen is known as the "Home Screen" because it is 1. AutoTest's startup screen 2. the base for all Measurement Mode selections 3. the entry screen to Menu Mode

2.7. AutoTest Power

An internal rechargeable lead-acid battery with a continuous operating life of up to 7 hours (when fully charged and the LCD backlight off) powers AutoTest.

2.7.1. Recharging the Internal Battery

A completely discharged AutoTest will be 75% recharged within 2 hours and fully recharged within 4 hours.

AutoTest's internal battery is recharged in one of two ways:

- by connecting its test clips to a battery (automotive battery is OK) with a voltage greater than 9 volts and less than 20 Volts (i.e. a 24 volt battery is not suitable and will damage AutoTest).
- Using a special cable to connect AutoTest's serial connector to a suitable DC voltage source (a DC voltage source between 9 and 20 volts). This can be via a plug that fits into a vehicle cigarette lighter socket.

When the test clips or special cable to the serial connector are connected to a DC source (i.e. a battery) greater than 9.0V (maximum 20V), AutoTest's internal battery recharges when:

- AutoTest is turned off, or
- AutoTest is in Menu Mode, or
- AutoTest is displaying the results of a Managed Test.

This means that the battery being tested can charge AutoTest when the above conditions are met.

When AutoTest is in constant use, the recommended recharging method for AutoTest is to connect it to a 12-volt automotive battery, switch it off and at the end of each day let it recharge overnight. This will ensure that the internal battery is always charged while avoiding unnecessary recharging that may reduce the internal battery's total cycle life. It is not recommended that AutoTest be recharged between uses.

Because AutoTest's charging system is self-regulating, it can be connected to a DC source for extended periods without harming the internal battery.

To see the amount of operating time remaining in AutoTest's internal battery at any time:

1. In the Home Screen, press the **MENU** button (alternate function of the **ENTER** button).

The first of the menu screens is displayed.

```
>1)Battery Life
 2)CCA Standard
 3)Print Settings
 4)Language**
```

2. The first option in the Menu Screen is the Battery Life screen. To select it press the **ENTER** button.

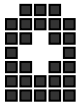
The Battery Life screen is shown below.

```
Battery Life 5.5 hrs

Min   ( 6.19V )  Max
■■■■■■■■■■
```

The number between the Min and Max markers on the third line of the display is the actual voltage reading from AutoTest's internal battery (nominally 6 Volts). When properly charged and maintained AutoTest's internal battery should have a service life of between 2 and 4 years.

2.7.2.Low Battery and Recharge Warning



AutoTest displays a flashing Low Battery icon about half an hour before it becomes inoperable. This icon is displayed in the lower right hand corner of the screen. When it is displayed it is recommended you immediately recharge the tester's internal battery.

AutoTest also has a feature that prevents the internal battery becoming completely discharged eliminating the risk of permanent damage through over discharge. It accurately monitors the internal battery's state of charge and it shuts the unit down before an over discharge condition is reached. When it shuts down the following screen is displayed:

```
AutoTest requires
immediate recharge.
Connect CLIPS to a
12V DC source NOW.
```

Once the clips have been successfully connected the following screen is displayed:

```
AutoTest Charging
Battery = 7.35 V
```

The voltage at which the battery is charging is displayed on the third line of the screen (in this case 7.35 V). There is a built in delay of 9.5 seconds before the charging circuit is switched on, so the voltage displayed will change from the internal battery's terminal voltage to the internal battery's charge voltage after 9.5 seconds.

If the clips are not connected to a charging voltage source the "recharge NOW" screen persists for 2 minutes before AutoTest completely shuts down.

3. AutoTest Home Screen and Access Buttons

The Home Screen

From the Home Screen the operator can observe the following:

- DC voltages being measured by the Multimeter Leads (**Leads Volts**)
- DC voltages being measured by the Test Clips (**Clips Volts**)
- DC electrical current being measured by the Current Probe (**Probe Amps**)
- Ambient temperature in the vicinity of the negative (black) test clip **(Clip Temp)**.

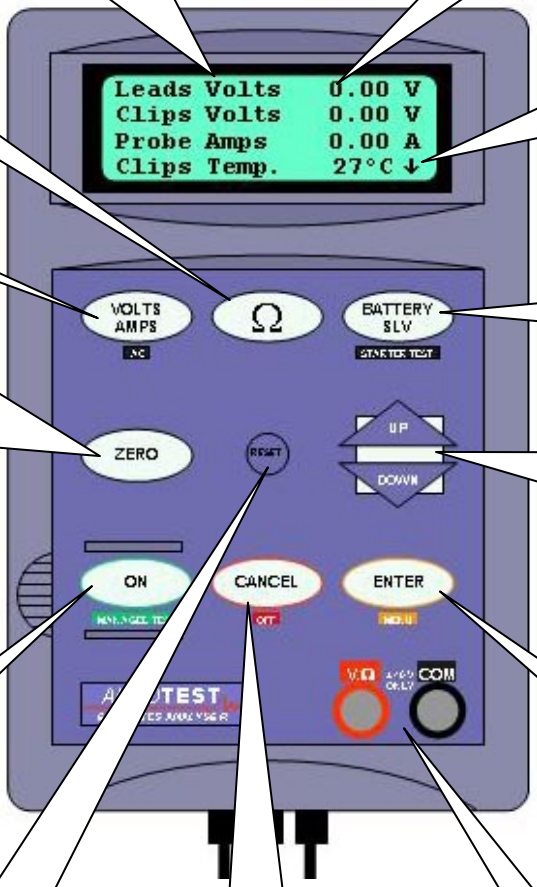
The following AutoTest functions can only be accessed from the Home Screen:

- Switch AutoTest off.
- Enter Menu Mode
- Start a Managed Test
- Start an SLV Test
- Start a Starter Motor Test
- Switch the back light on or off

To access resistance or diode volts measurement press the **Ω** button.

To access AC Voltage, current, pulse width, frequency and duty measurement press the **Volts-Amps** button.

The **down arrow** in the bottom right hand corner of the Home Screen indicates that there are further information screens that can be accessed by pressing the down arrow.



To access the **Simulated Load Voltage** Test (SLV) **or Starter Test** mode press the **Battery SLV** button.

The **Zero** button is used with the Amps Probe to determine the point of reference when measuring current.

The **backlight** of AutoTest's LCD can be switched on or off by pressing the **ZERO** button and holding it for two seconds.

The backlight should be switched off whenever possible to conserve internal battery life. Switching the backlight off can extend the internal battery life between charges by up to 30%.

The up and down arrows let you scroll through the menu options when selected. Also Among other things it lets you review the results screens of the last Managed Test that was performed from the Home Screen.

Press the **ON** button to turn the AutoTest On.

To Access the **Managed Test** mode you must press the **ON** button a second time.

To access the AutoTest **Menu** press the Enter button.

It is also used in different testing modes.

If AutoTest stops responding to the buttons press **RESET** (not **CANCEL**). Pressing the **RESET** button switches AutoTest off, when the unit is restarted by pressing the **ON** button its memory is reset and rechecked (during the power up memory tests) and is again ready for use.

Pressing the **CANCEL** button from any screen always returns you to the either the previous menu or to the Home Screen.

Pressing the **CANCEL** button from the Home Screen turns AutoTest off.

Tester multimeter/test leads point of connection

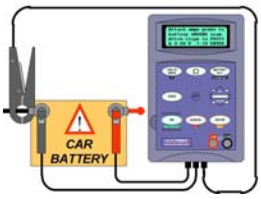
VΩ = Positive
COM = Negative

4. AutoTest Leads

AutoTest has three types of test leads:

- In Simulated Loaded Voltage (SLV) Test mode the **test clips** are used.

- In Managed Mode the test clips and the **Amps Probe** are used.



- In Measurement Mode the **multimeter/test leads** and the amps probe are used. It is also possible to use the negative test clip to establish a ground reference in Measurement Mode. Using the negative test clip in Measurement Mode means voltage readings can be taken handling only the positive test lead, a real advantage in cramped conditions.

4.1. Test Clips

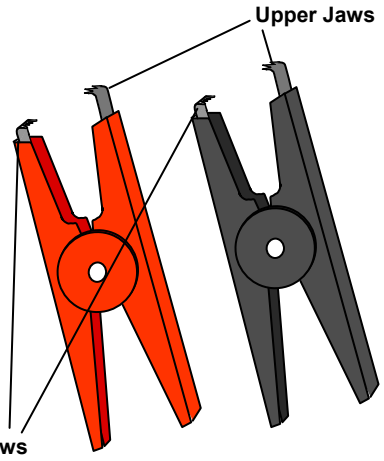
Positive (Red) and Negative (Black) Test leads fitted with **test clips** permanently connected to the analyser. They are used for temperature-compensated voltage measurements at the battery posts and clamps.

Test Clips

The upper (longer) jaw of each test clip must always be in direct contact with the test site (the battery post for example).

The lower (shorter) jaw should also contact the test site directly. If this is not possible, make sure the lower jaw is at least in contact with a conductive part that is itself in contact with the test site (the clamp around the battery post, for example).

Unlike conventional test clips, *both* jaws of each test clip must contact the test site for AutoTest to give accurate results.

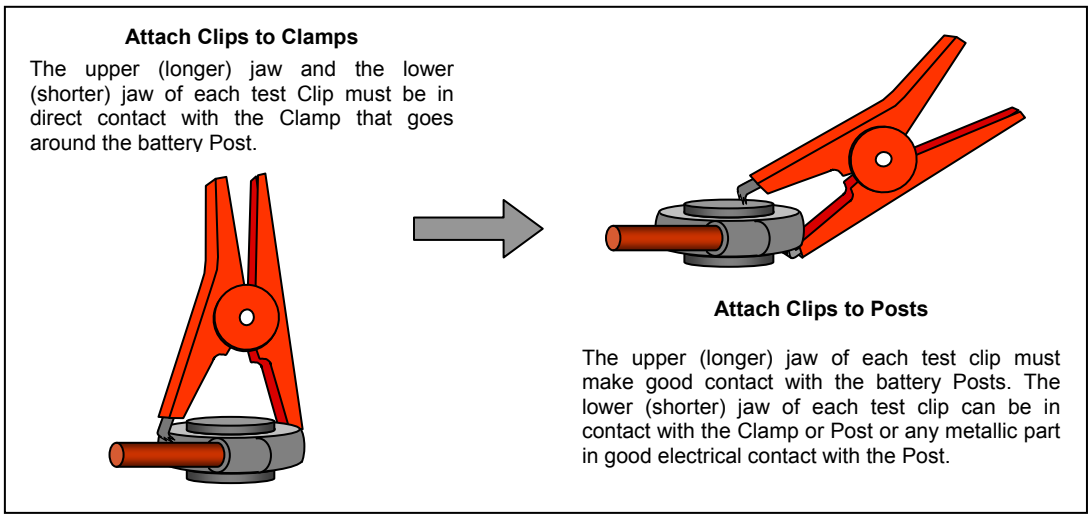


4.1.1. Using the test clips correctly:

For reliable results, both the upper and lower jaw of each test clip must make good electrical contact with the part being tested. Unlike a conventional test probe, it is not sufficient for just one of the jaws on each clip to make contact.

- When attaching to a battery clamp, BOTH jaws - upper and lower - MUST make good contact with the metal of the clamp. Do not, for example, allow the lower jaw to close on any insulated terminal cover that might be present.

- When attaching to a battery *post*, the upper (longer) jaw of the clip must be in contact with the post and the lower jaw must be in contact with either the post or the clamp.
- In Managed Test mode you'll be prompted to "attach to clamps" first and "attach clips to post". See next illustration for more info.

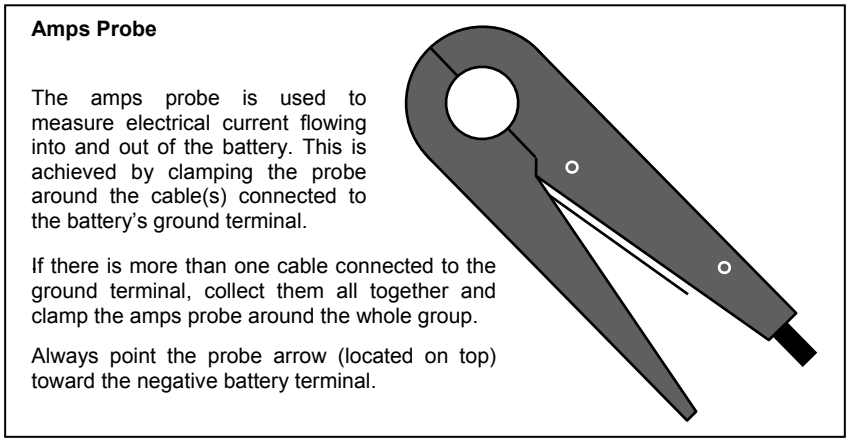

Attach Clips to Clamps
The upper (longer) jaw and the lower (shorter) jaw of each test Clip must be in direct contact with the Clamp that goes around the battery Post.
Attach Clips to Posts
The upper (longer) jaw of each test clip must make good contact with the battery Posts. The lower (shorter) jaw of each test clip can be in contact with the Clamp or Post or any metallic part in good electrical contact with the Post.

4.1.2.Concealed Battery Posts

Because of the battery clamp arrangements provided by some manufacturers, it is not always possible to position the test clamps in contact with the battery posts.
If this is the case, when the procedure directs you to connect the test clips to the battery *post(s)*, simply leave them connected to the battery *clamp(s)* and continue. AutoTest will carry out all tests, *but the result of the battery clamp-to-post test will not be valid* — the analyzer will not be able to detect poor battery clamp-to-post connections. (This may also compromise the battery evaluation).

4.2. Amps Probe

A current probe (called the **Amps Probe**) is also permanently connected to the analyser. It uses a pair of magnetic sensors to measure electrical current flowing through a cable.


Amps Probe
The amps probe is used to measure electrical current flowing into and out of the battery. This is achieved by clamping the probe around the cable(s) connected to the battery's ground terminal.
If there is more than one cable connected to the ground terminal, collect them all together and clamp the amps probe around the whole group.
Always point the probe arrow (located on top) toward the negative battery terminal.

4.2.1.Using the Amps Probe correctly

Correct use of the amps probe is vital.

The amps probe works by sensing the small magnetic field which is generated when an electric current flows through a cable. The probe must be clipped around the cable(s) connected to the battery's negative (ground) terminal; it only measures the current flowing through the cable(s) it is clamped around.

Because the current probe senses magnetic fields and because it is sensitive enough to read small leakage currents from a vehicle's battery, it is also sensitive enough to read the Earth's own magnetic field in the same way that a compass does. This means that the current probe readings will change when its orientation changes. For this reason it is important that the current probe is in the same orientation it will be when making readings when it is zeroed. Also it is important that the current probe does not change orientation while making a current reading.

For accurate readings, the probe must measure *all* of the current entering/leaving the vehicle's battery. Therefore, you must clip the amps probe around *all of the wires* connected to the battery's negative (ground) terminal. If they cannot all fit inside the Amps Probe while closing completely, you must add the results of your readings. If needed repeat the process for each cables and add up the results.

To use the amps probe, you firstly hold it in the "next-to" position (so that AutoTest can zero it), then in the "attached" position (so that AutoTest can make the measurement). These two positions are explained next.

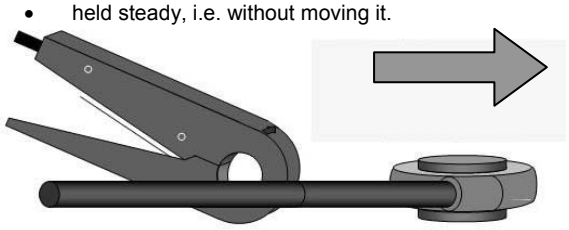
"Next-To" Position

When AutoTest prompts you to hold the amps probe next to GROUND lead, hold the probe clear of the vehicles metal components or any cables so that AutoTest can zero the probe reading without interference from any magnetic fields that metal components may generate or distort.

Make sure the Amps probe arrow (located on top) is directed toward the negative battery terminal, as it is important to keep the probe orientation and position the same while AutoTest zeros it and when you "attach" it.

The amps probe "Next-To" position is:

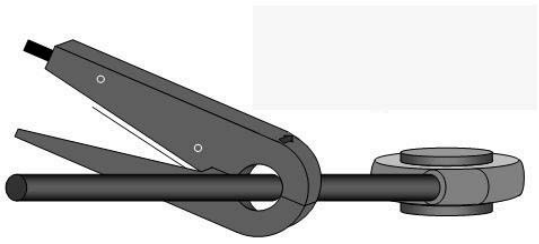
- well clear of any of the vehicles metal components. (e.g. Above the engine but away from any sheet metal)
- with its jaws fully closed
- held steady, i.e. without moving it.



"Attached" Position

When AutoTest prompts you to Attach amps probe to battery GROUND lead, simply squeeze open the jaws of the amps probe and clamp it around the battery negative (ground) cable(s) (or, more precisely, all cables connected to the negative terminal). **Keep the probe as perpendicular to the cable as possible.** To make the precise current measurements necessary for AutoTest to give accurate test results the amps probe must be held:

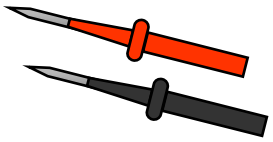
- with its jaws fully closed
- with no dirt or grease between the probe jaws metal contact surfaces
- held steady, i.e. held without moving it.



4.2.2.Using the Amps In the "Managed test" mode

The current is measured during the Managed Test. Remember that the AutoTest will prompt you to do the previous operations during its procedure.

4.3. Multimeter Test Leads



There are two removable test leads that plug into the **VΩ** and **COM** sockets on the front panel of the analyzer, fitted with straight probes.

When the Test Clips (described above) are connected to the vehicle battery, the negative test clip gives AutoTest a ground reference (to the battery negative terminal). This ground reference is sufficient for readings taken with the test leads so that only the positive test lead needs to be used to read voltages relative to the battery negative terminal.

5. AutoTest Menu

Menu Mode provides you with commands setting AutoTest's options, for printing AutoTest's results screens and stored data, transferring the data to a host computer, clearing data from the analyser's internal memory, reporting the version of the analyser's "firmware" (internal software) and viewing its available screens.

5.1. To enter Menu Mode:

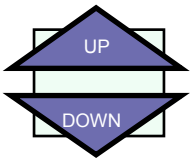
In the Home Screen, press the **MENU** button (alternate function of the **ENTER** button).

The first of three menu screens is displayed.

```
>1)Battery Life
 2)CCA Standard
 3)Printer Settings
 4)Language          ↑↓
```

Use the **DOWN** button to scroll down the screen. When at option 4 a further press of the **DOWN** button selects the next menu screen

```
>5)Download Results
 6)Print Results
 7)Clear Results
 8)Code Reader       ↑↓
```



Use the **DOWN** button to scroll down the screen. When at option 8 a further press of the **DOWN** button selects the last menu screen

```
>9)Version
 10)Screens
 11)Temp. Scale
 12)Time             ↑↓
```

IMPORTANT: Use the **UP** and **DOWN** buttons to select the desired command (the selection pointer ">" moves up/down the left edge of the screen), then press **ENTER** to initiate it.

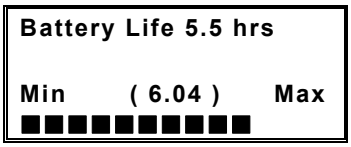
To leave Menu Mode, press the **CANCEL** button and AutoTest will return to the Home Screen.

5.2. Menu Mode Commands

The Menu Mode commands are described below.

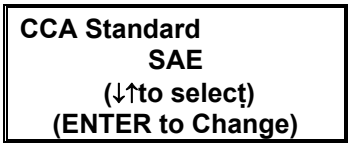
5.2.1. Battery Life

Use this command to see how much charge is in AutoTest's internal battery. Note that the time estimate of how long the battery will last is dependent on the state of the LCD backlight. Switching the backlight off (by pressing and holding the ZERO button for two seconds while the tester is in the Home Screen) will increase the battery life by up to 30%. By pressing enter at the menu option ***1) Battery Life*** you'll see:



5.2.2. CCA Standard

The CCA Standard command opens the following sub-menu screen:



The second line in this screen displays the options available. The options available depend on the market your tester was originally shipped to from the factory. In the case of the North American and Australian markets there is only one option for CCA standard:

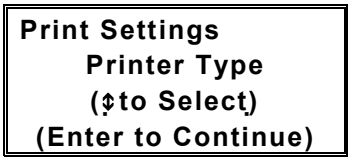
- SAE

In the case of Europe the options available are:

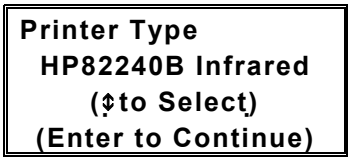
- SAE
- DIN
- Ah

5.2.3. Print Settings

This command is used to enable AutoTest to print to various printers. Print Settings opens the following sub-menu screen.



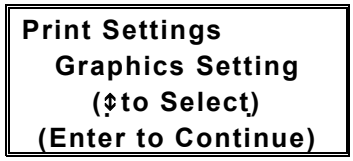
Pressing the **ENTER** button when this option is displayed brings up a further sub-menu:



Printers that are supported by AutoTest are shown on the second line of the screen. The other required printer parameters are automatically set for the printer type that is selected.

The printers that are currently supported by AutoTest are:

- Hewlett Packard HP82240B Infrared thermal portable printer. This printer requires that AutoTest is fitted with the optional infrared LED at the top of the tester. A specially modified protective cover with an opening for the LED is also available.
- Hewlett Packard 80 Column Serial. This setting uses the coms port and the standard AutoTest serial printer cable. It will also work with printers that have HP Serial printer control language emulation.
- Epson 80 Column Serial. This setting uses the coms port and the standard AutoTest serial printer cable. It will work with printers such as the Epson LX300+ and many other types of serial printers that support Epson serial printer control language.
- Citizen iDP-3111 portable impact printer. This setting uses the AutoTest coms port and a special serial printer cable.
- Seiko DPU-414 portable thermal printer. This setting uses the AutoTest coms port and a special serial printer cable.
- None. This setting is used to send unformatted text data. It is used when sending print data to a windows PC for later printing or to use the AutoPrint software that allows AutoTest reports to be sent directly to the Windows print spooler and to be printed out on any local or networked printer accessible from the PC.



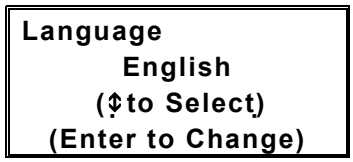
There are several other options that are available in the Printer Settings sub-menu. These settings can be manipulated independently of the printer selection. Refer to your printer's user guide for information on how to change these settings to suit your printer. The options that can be changed are:

- Graphics Setting. Set this to off and it does nothing. Set this to on to print out a graphic at the start of each printed report. The graphic can be loaded separately into AutoTest's flash memory using special software.
- Flow Control. This can be set to either Xon Xoff or Hardware flow control. The usual setting is Xon Xoff but some printers (the Citizen iDP311 for instance) require the use of hardware control of data flow. Setting to hardware flow control will require the use of a special printer cable that uses the Rx pin of AutoTest's coms port as the hardware flow control input.
- Print Width. AutoTest sends print data in either 24-column or 80-column format. Large format printers that use US Letter or A4 sheets use the 80-column format while many portable printers use narrow paper that can only accept 24 columns of print data per line.

5.2.4.Language

Note that the Language option in the Menu Screens has two * symbols after the option. This is to help in case AutoTest is accidentally set to another language and the user is having difficulty finding the option that will return it to the users native language. Look for the menu option that has ** after it and press the **ENTER** button.

The Language** command opens the following sub-menu screen:



The second line in this screen displays the options available. In this case there are three language options:

- English
- French
- German

Use the **UP** and **DOWN** buttons to select the language to which you want to change, then use the **ENTER** button to make the change.

Pressing the **ENTER** button also returns you to your previous position in the menu screens.

5.2.5.Download Results

The DOWNLOAD RESULTS command transmits the test results stored by AutoTest to the analyser's serial port for downloading to a computer. AutoTest stores 255 managed test results. When there are more than 200 tests since the last time the memory was cleared, the oldest results are overwritten by the latest results.

To read the results that are downloaded it is necessary to connect AutoTest to a PC serial port using the AutoTest coms cable and to set the PC as a terminal capable of accepting RS232 serial data. Users of Windows operating systems can use a program called Hyper Terminal that is available in the accessories folder to read AutoTest data.

AutoTest communicates using an RS232 serial interface at 9600 baud using 8 bits with 1 stop bit, no parity and Xon – Xoff flow control.

The results that are downloaded are shown below:

Test #	Test CCA	Battery Result	OCV	Rating Factor	Batt LV	Batt. Internal mOhm	Clamp Drop	Accum-ulated Ah	Alt & Reg. Result	Charge Volts	Charge Amps	Altern-ator Ripple	Current Drain Result	Drain Amps

Once downloaded it is a simple exercise to import the data directly to an Excel spreadsheet.

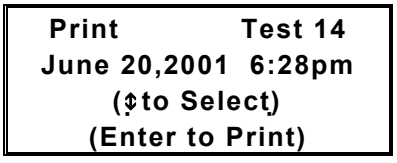
5.2.6.Print Results

There are several printing options available for AutoTest. Test results can be printed to any of the following devices:

- any printer connected to a PC or network using a Windows operating system via cable or Infrared link. This requires the use of AutoPrint, a Windows utility develop specifically for printing AutoTest reports to any office printer.
- the HP82240B portable infrared printer. Only AutoTests equipped with the internal Infrared LED are capable of printing to this device. The external Infrared adaptor is not compatible with this printer.
- other printers as described in Print Settings above.

The PRINT RESULTS command opens up the following sub-menu:

Selecting the "Last Managed Test" option as shown above and pressing the ENTER button brings up the following Print Managed Test Screen.



Pressing the **UP** and **DOWN** arrow buttons any of the stored Managed Tests can be selected and printed by pressing the **ENTER** button. If the real time clock was running at the time the test was performed the date and time will be displayed on the second line of the Print Managed Test Screen. If the real time clock was not running at the time of the Managed Test was run only the test number will be displayed.

Selecting the “The Last SLV Test” option as shown above and pressing the ENTER button prints the last stored SLV Test. Only one SLV test can be stored. An SLV test must be stored by pressing the ENTER button during an SLV test when the results are being displayed, before it can be printed.

Selecting the “All Managed Tests” option as shown above and pressing the **ENTER** button prints out the results of all Managed Tests that are stored in memory.

This will include all the tests since the last time test data was manually cleared from the AutoTest's internal memory up to a maximum of 240 Managed Test results. When there are more than 240 tests since the last time the memory was cleared, the oldest results are overwritten by the latest results.

AutoTest sends print data in serial format via its coms port at 9600 baud using 8 bits with 1 stop bit, no parity and Xon-Xoff flow control or hardware flow control (see Print Settings above).

Printing to the HP82240B Infrared Portable printer AutoTest uses a proprietary HP printer communications protocol that is sent via the internal Infrared LED. This print option is only available on AutoTests equipped with the internal Infrared LED.

5.2.7.Clear Results

The Clear Results command gives the operator the option to clear either the result of the last Managed Test, or the results of all Managed Tests stored in AutoTest’s internal memory.

On some units this function will be barred as a part of the factory configuration. This is done to prevent accidental deletion of data as requested by some customers.

5.2.8.Code Reader

The Code Reader command switches on AutoTest’s code reader function. When the Code Reader is switched on the bottom line of the Home Screen is used to display a solid bar that switches on and off when the multimeter leads detect a change in voltage logic states. When the positive test lead is connected to the active pin of a vehicles diagnostics output plug the bottom line of the Home Screen becomes a solid bar. When the vehicle’s ECU sends its diagnostic test codes the bottom line of the Home Screen flashes. By counting the flashes an operator can determine the test codes which are being sent by the vehicles on board diagnostic system.

Different vehicles send out different signal levels. If the default signal level does not work properly with the vehicle being tested then select a different voltage trigger level. The voltage trigger can be set from 1 to 11 volts in increments of 1 volt.

5.2.9.Version

The Version command tells the operator the hardware and software version that is being used by AutoTest. It also displays the AutoTest serial number and the last time the tester was calibrated.

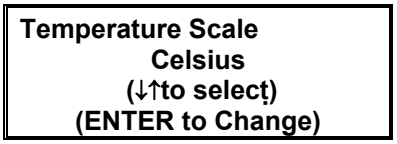
The calibration date feature is useful for organisations that need to meet ISO9000 standards for the calibration of measuring instruments.

5.2.10. Screens

The Screens command enables the user to scroll through the entire list of screens that are used by AutoTest. There are over 100 screens in each language. Many of the screens are for features that are not yet utilised by the current release of AutoTest software.

5.2.11. Temperature Scale

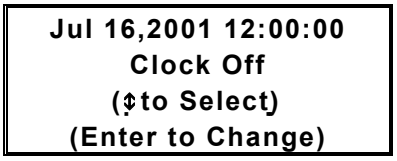
The Temperature Scale command opens the following sub-menu screen:



The second line in this screen displays the options available. In this case there are only two options, *Celsius* and *Fahrenheit*. Use the **UP** and **DOWN** buttons to select the option to which you want to change, then use the **ENTER** button to make the change. Pressing the **ENTER** button also returns you to your previous position in the menu screens.

5.2.12. Time

This option is displayed only when the real time clock function of AutoTest is enabled. With the real time clock enabled, AutoTest can time and date stamp each of the test results it stores.



Warning: The real time clock function of AutoTest significantly increases its standby current consumption. AutoTest's real time clock function should only be switched on when the tester is put on charge overnight EVERY night. Failure to do so will significantly shorted the service life of AutoTest's rechargeable internal battery.

The options available for enabling and setting the real time clock are shown below:

Pressing the **ENTER** button when this option is displayed switches the real time clock off. The "Clock Off" option that shows on the second line of the Date/Time Screen when the Time menu command is selected and the clock is not running.

The "Clock On" option is the option that shows on the second line of the Date/Time Screen when the Time menu command is selected and the clock is already running.

Selecting the “Clock On” option by pressing the **UP** or **DOWN** arrow buttons and then pressing the **ENTER** button starts the clock running from the time that is currently stored in AutoTest’s memory.

```
Set Date/Time
```

When the “Set Date/Time” option is selected by pressing the **UP** or **DOWN** arrow buttons and the **ENTER** button is pressed the date and time of the real time clock can be set. AutoTest displays the following screen to set the date and time.

```
Year 2001   Month 7
Day    16   Hour 16
Minute 54   Second55
```

The underlined field indicates the current field (the month field in the screen above). The current field can be adjusted using the **UP** and **DOWN** arrow buttons. The **ENTER** button moves to the next field. Pressing the **ENTER** button for the last field (the Seconds field) sets the date and time and starts the clock running, The **CANCEL** button moves the active field to the previous field. Pressing the **CANCEL** button from the first field cancels setting of the date and time.

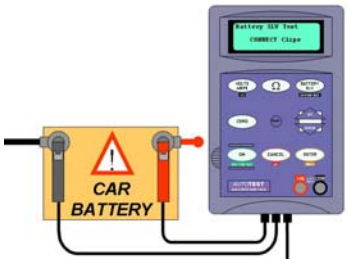
```
Time Correction
```

When the “Time Correction” option is selected by pressing the **UP** or **DOWN** arrow buttons and the **ENTER** button is pressed the real time clock can be adjusted to make it run slightly faster or slower. The time correction function has been added so that the clock can run accurately in the temperatures in which AutoTest has been designed to operate. The Time Correction Screen is shown below.

```
Up for faster clock
Down for slower.
Time error over 24hr
     0.00 seconds
```

Measure the time on a known accurate clock over several days and compare it to the time as measured by AutoTest over the same period. This determines the time error over several days. Next divide the time error by the number of days over which it was measured. This is the time error over 24 hours that must be entered into the Time Correction Screen using the **UP** and **DOWN** arrow buttons.

6. AutoTest Simulated Loaded Voltage (SLV) Test



6.2. Introduction

The SLV Test measures a battery's Simulated Loaded Voltage (SLV). The loaded volts test is a traditional measure of condition of automotive battery. It assesses the battery's ability to crank a vehicle's engine by determining how the battery voltage holds up under a high amperage load. AutoTest uses its unique pulsed impedance testing method to simulate a ½ CCA current 15-second load test on the battery (BCI test) that takes seconds to perform.

At the conclusion of the test, The SLV Test results display the following results via its LCD (liquid crystal display) screen:

- The **Battery Rating** as a percentage of service life remaining in the battery (except when the initial open circuit voltage (no load voltage) is under 12.2 volts).
- The **SLV** or Simulated Loaded Voltage.

The sections below take you step-by-step through AutoTest's SLV Test Mode.

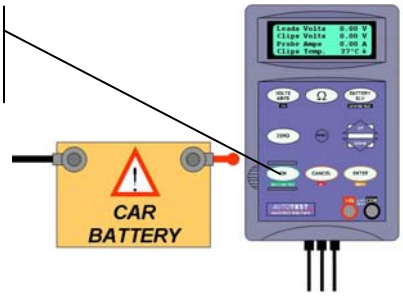
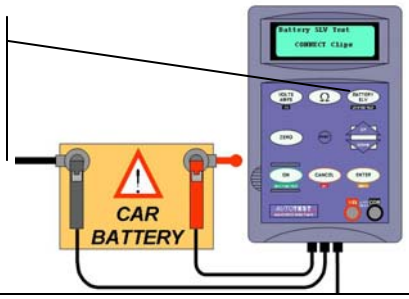
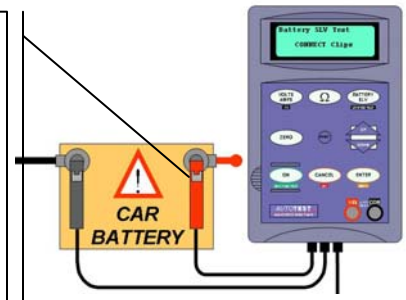
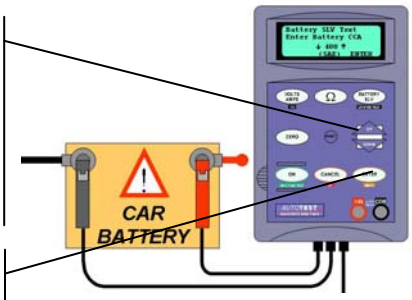
6.3. Preliminaries

- Check the electrolyte levels in the vehicle battery to be tested.
- If low (or if the battery is a sealed type that you suspect is low) refer to "Electrolyte Level" in the section "AutoTest Essentials" earlier in this manual.
- The battery MUST have an initial voltage of 1 volt minimum to conduct the managed test. If you don't, the AutoTest will ask you to reconnect your clips.

Note 1: Loaded volts measurements may *not* be valid if the battery's specific gravity is less than 1180, and/or the battery's *stable* open-circuit voltage is less than 12.1 volts.

Note 2: In SLV Mode, you use the analyzer's test clips. The multimeter test leads and Amps probe are not required.

6.4. AutoTest Simulated Loaded Voltage Testing Procedure

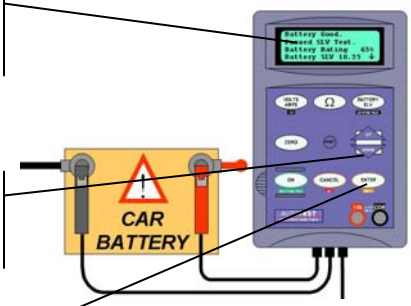
Directions	Screens and Explanations
1) Press the "ON" button to turn the tester "ON" . 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C ↓** This screen is known as the "Home Screen" because it is **1.** AutoTest's startup screen **2.** the base for all Measurement Mode selections **3.** the entry screen to Menu Mode
2) Press the "Battery SLV" button to begin the test. 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C ↓**
3) Connect the test clips to the battery posts — black clip to the negative post, red clip to the positive post. Make sure that the upper/longer jaw of each test clip makes direct contact with the battery ***post***, not just with the battery clamp that surrounds the post. 	AutoTest prompts you to connect the test clips. **Battery SLV Test** **CONNECT Clips** Note: AutoTest will prompt you for reconnection if you reverse the polarity of the test leads.
4) Use the **UP** and **DOWN** buttons to select the CCA (cold cranking amps) value of the vehicle's battery. 5) Press the Enter button. 	When AutoTest detects that you have connected the test clips to the battery, the select CCA screen appears. **Battery SLV Test** **ENTER battery CCA** **↓ 400 ↓** **(SAE) ENTER** *It is important to select the correct CCA value here (± 50 CCA).* If the CCA rating is not shown on the battery, refer to the vehicle handbook or a battery catalog to find the recommended battery CCA value for the vehicle under test.

Directions

6) Here's the test results.

7) Scroll down to view the measurements.

8) Press enter to store your last SLV test results. measurements.



Screens and Explanations

When you have selected the correct CCA value, press **ENTER**. AutoTest carries out the Battery SLV test and analysis, then displays the results:

```
Battery MAGINAL.
Passed SLV Test
Battery Rating   13%
Battery SLV      9.73 V ↓
```

In this screen the first two lines describe the results of the SLV test

```
Battery Rating   13%
```

The battery rating gives the operator an indication of the condition of the battery being tested. A battery rating of 0% indicates a battery that is on the borderline between pass and fail. A negative rating is for a reject battery, the larger the negative percentage the worse the battery. A Rating of 100% indicates the battery is in "as new" condition. **The battery rating is only displayed when the initial open circuit voltage (no load voltage) is above 12.2 volts.** The Rating Factor is not displayed if a "Charge Battery" or "Batt over discharged" message is given in the first line of the screen.

```
Battery SLV      9.73 V ↓
```

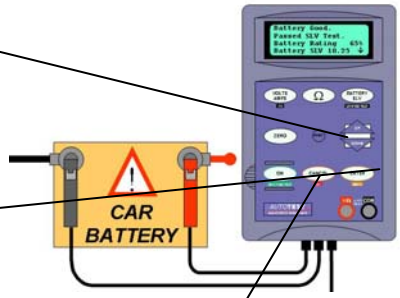
The Simulated Loaded Voltage of the battery. The Loaded Voltage of the battery is defined as the final voltage that would result after a ½ CCA current load is applied to a fully charged battery for 15 seconds. For a fully charged battery an SLV below 9.6 volts results in a reject battery.

See **section 6.4** ***Possible battery test results from the AutoTest SLV Test*** for more possible test results.

8) Keep scrolling down to print your last SLV test results.

9) Make sure that the AutoTest transmitter is in alignement with the printer receiver and press and hold the ENTER button until you hear a « beep > from the AutoTest.

10) Press Clear to end the test.



You have the option to print your last SLV test results by scrolling down to this screen:

```
To Print SLV Test
Results Press ENTER
                  ↓
```

To do so you must have a compatible IR printer like the *Hewlett Packard* Infrared Printer, model: HP82240B.

Important: If you disconnect your test clips prior to saving your test results, you'll have to do the test over again.

Just don't forget to press the ENTER button (see 8)) to save your test results.

You can recall them later on by scrolling up even if the test clips are disconnected.

6.5. Possible battery test results from the AutoTest SLV Test

Battery Good. Passed SLV Test: The test battery is fit for service. It is well charged and has passed the SLV test.

Battery Good. Requires Charge: The test battery is fit for service but is undercharged. The battery should be charged as soon as possible. The battery's condition will deteriorate if not charged before being put into storage.

Battery Marginal. Passed SLV Test: The test battery is fit for service and is well charged, but it is nearing the end of its service life. Marginal batteries have a Battery Rating of between 0% and 30%

Replace Battery. Failed SLV Test: The battery has failed the SLV test and should not be returned to service. The battery may continue to start a vehicle for the time being but its reliability is questionable. The more negative the Battery Rating the more unreliable the test battery.

Replace Battery. High Internal Resistance: The battery has failed the SLV test and should not be returned to service. The battery also has very high internal resistance.

Replace Battery. Likely shorted cell: The battery has failed the SLV test and should not be returned to service. The problem with the battery is most likely to be a short in one or more of its cells.

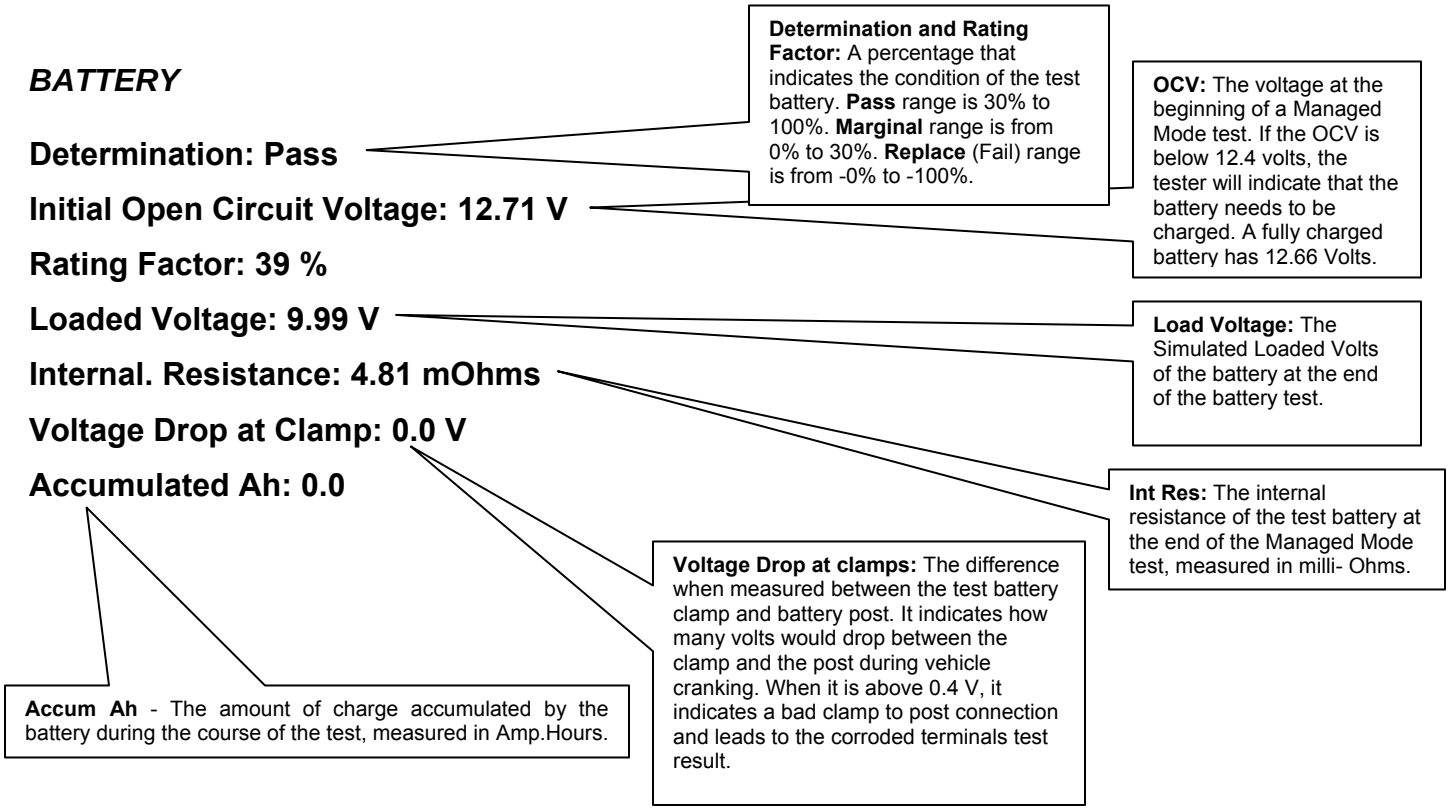
Charge Battery. High Internal resistance: This message indicates that the battery needs to be charged before it can be determined if it is a good or a bad battery. It also indicates that the battery has very high internal resistance often caused by a battery being left in a discharged state for a prolonged period of time. When the battery is first put on charge the high internal resistance condition should disappear after a very short period (less than 30 seconds for a good quality battery charger or a properly functioning vehicle charging system). **If the high internal resistance message does not change to "May pass Test after charge" (see below) well within 30 seconds of the commencement of charge then the battery probably has a serious inter cell fault and will not recover.**

Charge battery. May pass after charge: The battery needs to be charged before it can be determined if it is a good or a bad battery. To monitor the rate of improvement in the condition of the battery while it is being charged enter the Monitor Screen.

Batt over discharged. High internal resistance: This message indicates a battery that is extremely discharged. It will require a long charge for this battery to recover. It also indicates that the battery has very high internal resistance often caused by a battery being left in a discharged state for a prolonged period of time. When the battery is first put on charge the high internal resistance condition should disappear after a very short period (less than 30 seconds for a good quality battery charger or a properly functioning vehicle charging system). **If the high internal resistance message persists for more than 30 seconds after the commencement of charge then the battery probably has a serious inter cell fault and will not recover.**

Batt over discharged. Long charge required: This message indicates a battery that is extremely discharged. It will require a long charge for this battery to recover. It is recommended that a battery that displays this message is charged overnight with an external battery charger.

6.6. SLV Test Results Analysis


BATTERY
Determination: Pass
Initial Open Circuit Voltage: 12.71 V
Rating Factor: 39 %
Loaded Voltage: 9.99 V
Internal. Resistance: 4.81 mOhms
Voltage Drop at Clamp: 0.0 V
Accumulated Ah: 0.0
Determination and Rating Factor: A percentage that indicates the condition of the test battery. Pass range is 30% to 100%. Marginal range is from 0% to 30%. Replace (Fail) range is from -0% to -100%.
OCV: The voltage at the beginning of a Managed Mode test. If the OCV is below 12.4 volts, the tester will indicate that the battery needs to be charged. A fully charged battery has 12.66 Volts.
Load Voltage: The Simulated Loaded Volts of the battery at the end of the battery test.
Int Res: The internal resistance of the test battery at the end of the Managed Mode test, measured in milli- Ohms.
Voltage Drop at clamps: The difference when measured between the test battery clamp and battery post. It indicates how many volts would drop between the clamp and the post during vehicle cranking. When it is above 0.4 V, it indicates a bad clamp to post connection and leads to the corroded terminals test result.
Accum Ah - The amount of charge accumulated by the battery during the course of the test, measured in Amp.Hours.

6.7. AutoTest SLV Parameters

These are the parameters that will determine the pass, marginal, fail or “needs charge” state of the battery.

OCV (Open Circuit Voltage)

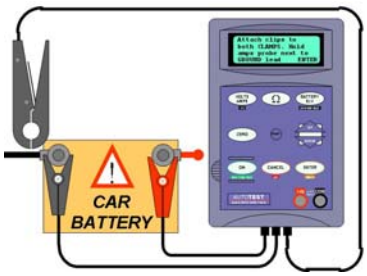
Battery doesn’t need charge = 12.4 V to 12 .66 V
Battery needs charge = Less than 12.4 V

*LV (Load Voltage) (*As determined by the Battery Council International-BCI)

Battery Pass 9.91 V to 10.6 V (31% to 100 % Rating)	**Battery Marginal** 9.6 V to 9.9 V (0% to 30 % Rating)	**Battery Fail** Less than 9.6 V (Under 0% Rating)
10.6 V = 100 % 10.5 V = 90 % 10.4 V = 80 % 10.3 V = 70 % 10.2 V = 60 % 10.1 V = 50 % 10 V = 40 % 9.91 V = 31 %	9.9 V = 30% 9.8 V = 20 % 9.7 V = 10 % 9.6 V = 0 %	9.5 V = - 10 % 9.4 V = - 20 % 9.3 V = - 30 % 9.2 V = - 40 % 9.1 V = - 50 % 8.6 V = -100 %

7. AutoTest Managed Test

7.2. Introduction



AutoTest's Managed Test is a microprocessor-managed test sequence that takes the operator through a series of diagnostic steps that evaluates the:

- Battery condition and **Rating** as a percentage of service life remaining in the battery (except when the initial open circuit voltage (no load voltage) is under 12.2 volts).
- Alternator/regulator output
- Integrity of battery clamp to battery post connections
- "Key-off"/parasitic drain (current drain from the battery when the ignition key is off).

If the integrity of battery connections is found to be suspect, the result is immediately reported to the operator and the managed test is discontinued.

At the conclusion of the test, AutoTest reports the results via its LCD (liquid crystal display) screen.

The sections below take you step-by-step through AutoTest's Managed Mode.

7.3. Preliminaries

- Check the electrolyte levels in the vehicle battery to be tested.
- If low (or if the battery is a sealed type that you suspect is low) refer to "Electrolyte Level" in the section "AutoTest Essentials" earlier in this manual.
- The battery MUST have an initial voltage of 1 volt minimum to conduct the managed test. If you don't, the AutoTest will ask you to reconnect your clips.

Note 1: Loaded volts measurements may *not* be valid if the battery's specific gravity is less than 1180, and/or the battery's *stable* open-circuit voltage is less than 12.1 volts.

Note 2: In Managed Mode, you use the analyzer's test clips and the amps probe. The multimeter test leads are not required.

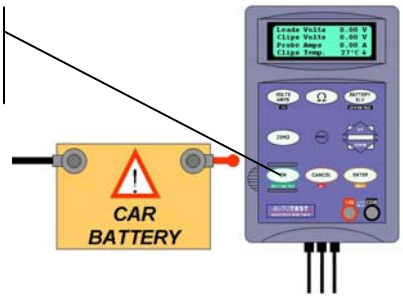
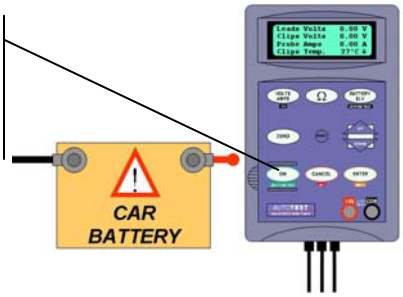
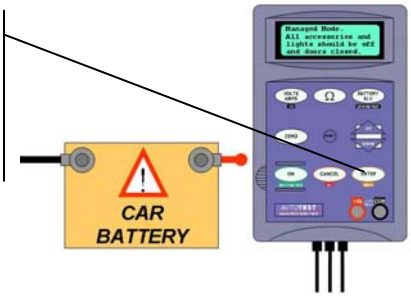
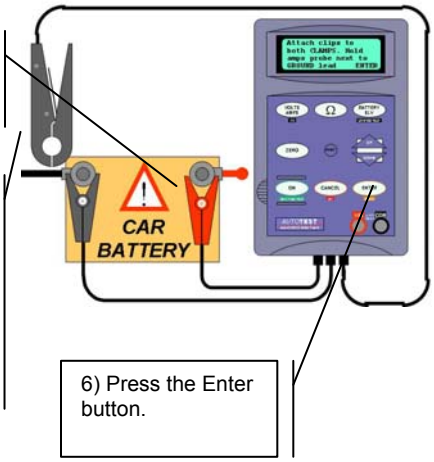
7.4. AutoTest Managed Test Testing Procedure

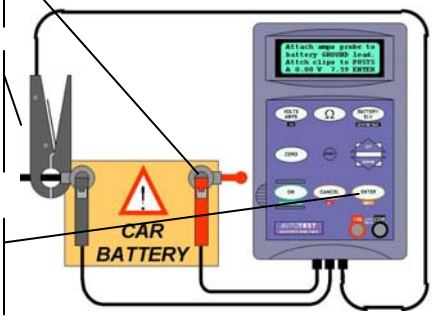
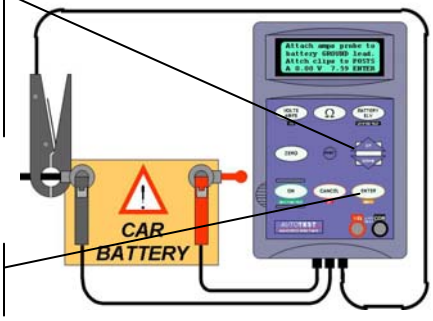
There are 3 sequential steps to accomplish a Managed/Dynamic Test:

- The testing setup
- The static test/engine not running test
- Dynamic test

You must perform each step to complete the test except when AutoTest stops you before the end because of a battery with a high internal resistance or shorted cell.

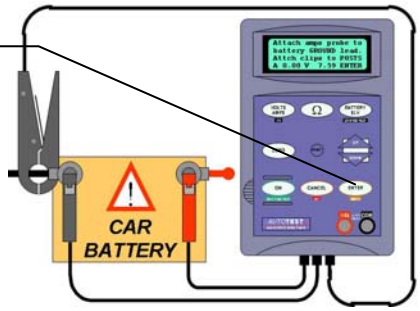
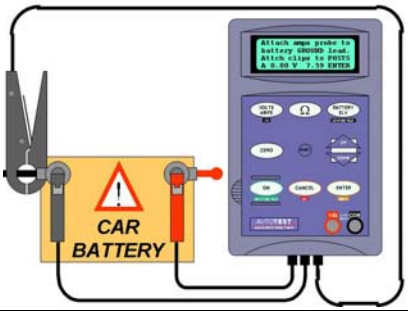
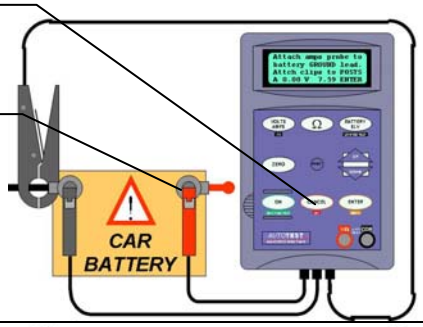
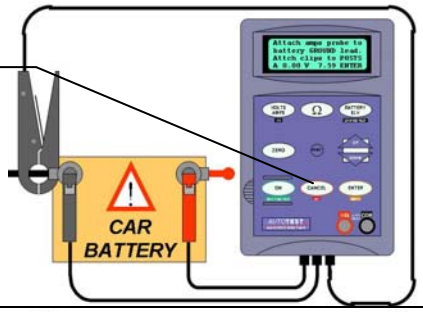
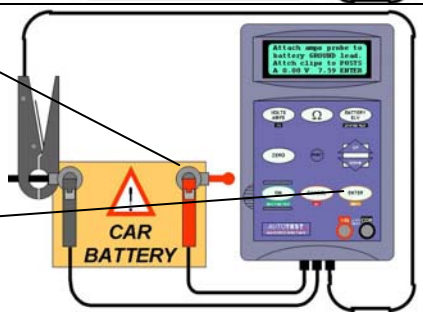
7.5. AutoTest Managed Test Procedure/Testing Setup (Step 1)

Directions	Screens and Explanations
1) Press the "ON" button to turn the tester "ON" . 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C ↓** This screen is known as the "Home Screen" because it is **1.** AutoTest's startup screen **2.** the base for all Measurement Mode selections **3.** the entry screen to Menu Mode.
2) Press the "ON" again button to begin the managed test. 	**Managed Mode** **All accessories and lights should be off and doors closed.** A reminder screen appears, prompting you to turn off all known electrical loads (driving and parking lights, radio, car phone and charger, etc.) and close doors, glove box and trunk so that all courtesy lights are off. Current drawn by the vehicle's clock is negligible and can be ignored Note: If a high key-off current drain is reported in the results screens at the completion of the test, the most likely cause is the vehicle's trunk light. You will probably have to disable the trunk light switch to be absolutely certain that this is not staying on even when the trunk is closed.
3) The next screen will appear after a few seconds (or press **ENTER** if you can't wait). 	**Managed Mode** **All accessories and lights should be off and doors closed.** The next screen will appear after a few seconds (or press **ENTER** if you can't wait).
4) Attach both clips to the battery clamps. 5) Hold the Amps probe next to the negative cable and wait for the next screen. The probe arrow pointing toward the battery. 6) Press the Enter button. 	**Attach test clips to both CLAMPS. Hold amps probe next to GROUND lead. ENTER** Do as the screen asks: connect the test clips to the battery clamps and hold the amps probe in the next-to position (Please see Multimeter section on how to use the Amps Probe) beside the battery ground lead. Make sure that both jaws of each test clip make direct contact with the battery clamps only — they must not contact any part of the posts. (AutoTest is protected against reverse polarity. It will simply prompt you for reconnection if you reverse the polarity of the test clips.)

Directions	Screens and Explanations
7) Attach both clips to the battery posts. 8) Attach Amps Probe to the battery ground cable. 9) Press the Enter button. 	**Attach amps probe to battery GROUND lead Attach clips to both POSTS. ENTER** Move the amps probe to the attached position and connect the test clips to the battery posts. **The upper/longer jaw of each clip must be in direct contact with the POST.**
10) Using the up and down arrows select the recommendated OEM vehicle battery CCA. 11) Press the Enter button. 	**ENTER battery CCA** **↑400↓** **(SAE)** The letters in brackets below the CCA value indicate the battery size standard that is being used by AutoTest. Different battery size standards (DIN, IEC and EN) can be selected from the Menu screens. *It is important to select the correct CCA value here (± 50 CCA).* If the CCA rating is not shown on the battery, refer to the vehicle handbook or a battery catalog to find the recommended battery CCA value for the vehicle under test. You are now ready for the next step. See **sub-section 7.5** ***Static Tests/Engine not running (Step 2).***

7.6. AutoTest Managed Test - Static Tests/Engine not running (Step 2)

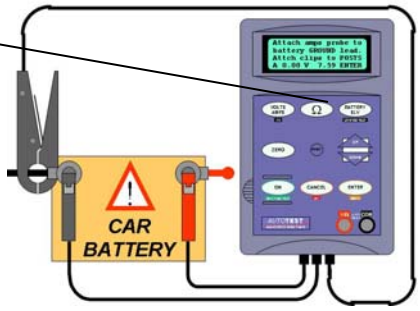
AutoTest carries out a battery clamp-to-post test and a **screening test for serious battery faults**. Depending on the results of these tests, AutoTest displays one of the following five screens:

	Directions	Screens and Explanations
1- Battery OK	Press Enter and go to Step 3 (Dynamic Tests). 	**Start Motor** **Amps 0.54** **ENTER** The above screen appears if no serious battery faults were detected and the battery has enough charge to start the vehicle. Press **Enter** and go to **sub-section 7.6** ***Dynamic Tests (Step 3)***.
2-Battery OK but Discharged	**Before Pressing the ENTER button go to Step 3 (Dynamic Tests) and follow procedure to connect jumper lead cables.** 	**Connect jumper leads GROUND to CHASSIS LAST. Start motor.** **Amps 0.54** **ENTER** The above screen appears if no serious battery faults were detected but the battery does not have enough charge to start the vehicle. Before pressing **Enter,** go to **sub-section 7.6** ***Dynamic Tests (Step 3)***.
3-Clamp-to-post problem	Press the Cancel button. Remove the battery clamps, clean the clamps and posts, then replace and tighten the clamps. 	**Battery terminals corroded. Clean and re-test.** The above screen appears if AutoTest detected an excessive battery clamp-to-post voltage drop (total of both terminals). 1. Press **CANCEL** to stop the test (AutoTest returns to the Home Screen). 2. Remove the battery clamps, clean the clamps and posts, then replace and tighten the clamps. 3. **Start over the Managed Test.**
4-Suspected Shorted Cell	Press the Cancel button. 	**Battery REJECTED** **Suspected shorted cell** The above screen appears if AutoTest detected a shorted cell. 1. Press **CANCEL** to stop the test (AutoTest returns to the Home Screen). 2. **Inform the client that a new battery is required.**
5-High Resistance Condition	Check that both test clips are connected correctly to the battery. Press the Enter button. 	**Check that both test clips are correctly connected to the battery Posts ENTER** The above screen appears if AutoTest detected a **high resistance condition** that is not due to poor clamp-to-post (AutoTest's clamp-to-post test has already ruled out this option). So, in case the fault is simply due to the test clips not making firm connection with the battery posts, check these connections as prompted by the screen above and then press Enter and go **sub-section 7.8** ***High Resistance Tests.***.

7.7. AutoTest Managed Test - Dynamic Tests (Step 3)

Directions

1a) Press the Enter button.



Screens and Explanations

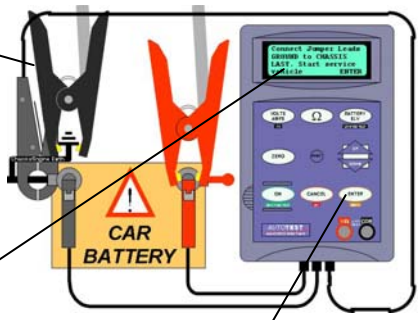
If the battery <u>is capable</u> of starting the test vehicle, the following screen appears:

Start motor	
Amps 0.54	ENTER

In this case:
1. Start the test vehicle.
2. If necessary, raise the vehicle's idle speed to obtain maximum charging current (shown in the screen).
3. Press ENTER and **go directly to 6).** If AutoTest does not respond by moving to the next screen, turn on electrical loads in the test vehicle (fan, wipers, air conditioning etc.) then press **ENTER** again. When AutoTest responds, turn the loads off before proceeding.

1b) Connect positive Jumper leads to positive battery terminal and negative to **chassis last.**

2) Start the disabled vehicle engine.



3) Press the Enter button.

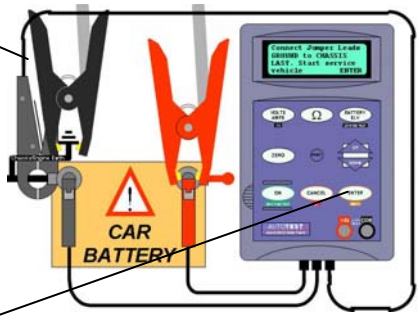
If the battery <u>is not capable</u> of starting the test vehicle, the following screen appears:

CONNECT jumper leads	
GROUND to CHASSIS	
LAST. Start motor	
Amps 0.54	ENTER

In this case:
1. Connect jumper leads from your service vehicle (or booster pack) to the test vehicle (follow standard operating procedure). The service vehicle does not have to be running.
2. Be sure to connect the negative jumper lead to the <u>chassis</u> of the test vehicle so that, in a later step, the amps probe gives a true reading of the current being accepted by the battery.
3. Start the test/disabled vehicle.
4. Press **ENTER** once the motor is running.

---

4) Remove jumper leads. Negative first and positive last.



5) Press the Enter button.

The charge monitoring screen appears.

Vch 14.3	Amps 37.2
Check batt recovery	
REMOVE jumper leads	
if OK	ENTER

1. If necessary, raise the vehicle's idle speed to obtain maximum charging current (shown in the screen).
2. Observe the battery voltage (Vch) and current being accepted by the test battery (Amps) in the screen and use these to judge when to remove the jumper leads (according to standard operating procedure).
3. When you've removed the jumper leads, press **ENTER**.

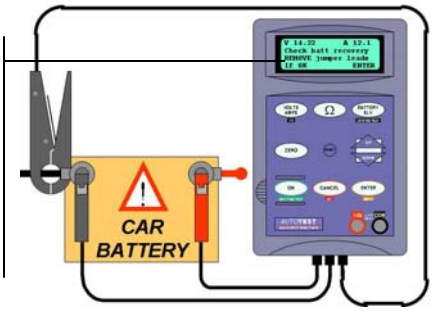
Note: a drained battery may initially accept very little charge when jump starting. Yet, 10 or 15 minutes later, the battery will readily accept a higher, useful amount of charge.

Directions

Screens and Explanations

6) AutoTest begins its dynamic tests of the alternator/ regulator combination and the battery.

Just wait for the test to be completed.



AutoTest begins its dynamic tests of the alternator/regulator combination and the battery. It displays

Testing alternator
Do not stop motor
Vch 14.44 Amps 4.33
Please wait 1:20

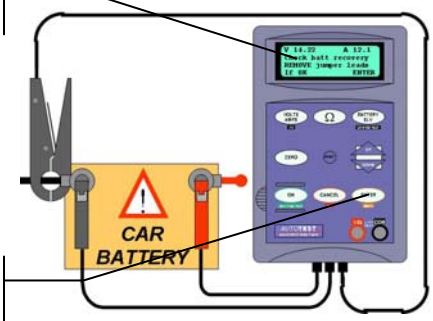
followed by:

Testing battery
Do not stop motor
Vch 14.44 Amps 4.33
Please wait 0:59

The test time remaining is shown (in minutes and seconds) in the lower right corner of these screens. The test will take 30 sec. to 4 min. depending on the initial condition of the battery.

7) The test is done.

8) Press the Enter button to see the results.



When AutoTest completes these tests, it displays one of two screens. If the battery was OK in the earlier steps, the following screen appears:

Vch 14.65	**Amps 1.23**
Test completed.	
Stop motor ONLY	
if OK.	**ENTER**

In this case:
1. Stop the motor if and when Vch and Amps are adequate to re-start the vehicle and support normal driving.
2. Press **ENTER** to view the results of the Managed Test.

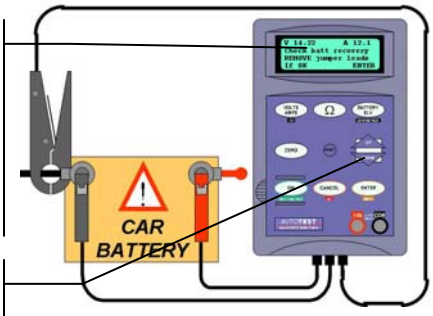
Note: Sometimes the battery will not have enough charge for AutoTest to carry out a reliable key-off current drain test in the earlier steps, the following screen appears:

Vch 14.65	**Amps 1.23**
Drain test	
Stop motor ONLY	
if OK.	**ENTER**

In this case go to the **sub-section 7.7** ***Drain test when battery is too discharged*** and follow the procedure.

9) AutoTest has five results screens. The first screen gives a summary of the battery condition, the alternator/regulator condition, and the key-off drain results.

10) The down arrow (↓) at the bottom of the screen prompts you to press the **DOWN** button to see the next results



AutoTest first displays the Summary Screen, which contains AutoTest's analysis of battery condition, alternator/regulator condition, and current drain from the battery when the ignition is turned off.

Typical summary results are "pass", "pass, needs charge", "marginal", "replace", "suspect" and "reject".

Summary Screen:

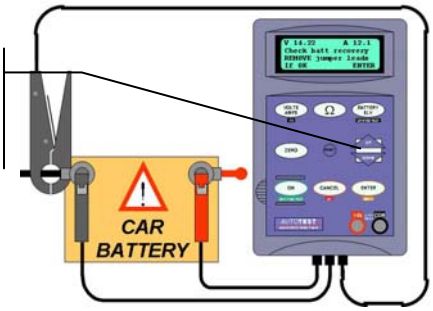
Batt	**PASS**
Alt/Reg	**PASS**
Drain	**SUSPECT**
	↑↓

See the **sub-section 7.10** ***AutoTest Managed Test Results Analysis*** for explanation about each line of the test results.

Directions

Screens and Explanations

11) Keep scrolling up or down to review all the screen results.



Here are the next 4 results screens. Just keep scrolling down to view them.

Results Screen 1: Gives the detail of the Managed Mode Test results. Screen 1 tells the operator the initial open circuit voltage of the test battery (OCV) the level of key-off current being drained from the battery as well as the drop in loaded voltage that was found between the battery clamp and battery post.

Battery OCV	**12.52 V**
Drain Amps	**0.35 A**
Clamp drop	**0.05 V**
	↑↓

Results Screen 2: Gives detailed information about the performance of the vehicles charging system. It shows the maximum charge volts and amps that were obtained during the alternator test (at the beginning of the dynamic tests with the engine running) as well as the alternator's ripple voltage.

Charge Volts	**14.63 V**
Charge Amps	**0.80 A**
Alt ripple	**50.5m V**
	↑↓

Results Screen 3: Gives detailed information about the performance of the vehicles battery. It shows the loaded volts the battery would achieve if it were subjected to a half current BCI load test, the accumulated current the battery accepted during the Managed Test as well as the battery's internal resistance.

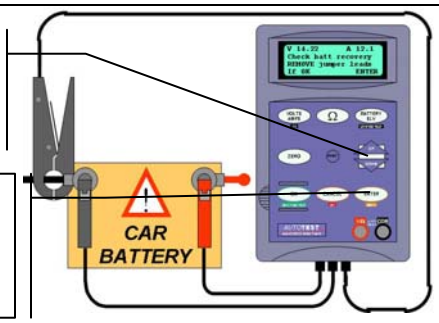
Battery LV	**10.05 V**
ACCUM Ah	**0.09Ah**
Battery Res	**11.6 mΩ**
	↑↓

Results Screen 4: Gives the Battery Rating (only displayed when the test battery is sufficiently charged). The Battery Rating is an indicator of the battery's condition. A Battery Rating of 100% indicates a battery that is in new condition, while a Battery Rating approaching 0% indicates the battery is toward the end of its useful life. A negative percentage indicates a reject battery.

Battery Rating	**45 %**
	↓

12) Keep scrolling down to the last screen to view the printing option.

13) Make sure your IR transmitter is an alignment with the printer receiver and press the Enter button.

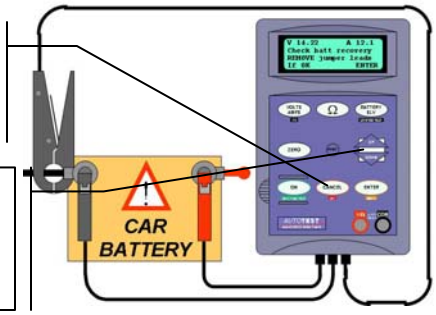


To Print the Last
Managed Test Results
Press ENTER

If you keep pressing all the way down, the last screen that you will see will give you the option to print the test results. To do so you must have a compatible IR printer like the *Hewlett Packard* Infrared Printer, model: HP82240B.

14) Press the Cancel button to complete the test and to return to the HOME screen.

15) If you need to review the last Managed test just the Down arrow from the Home screen.

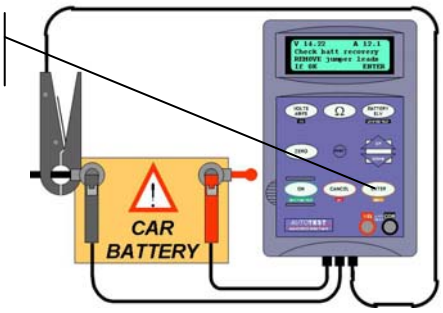
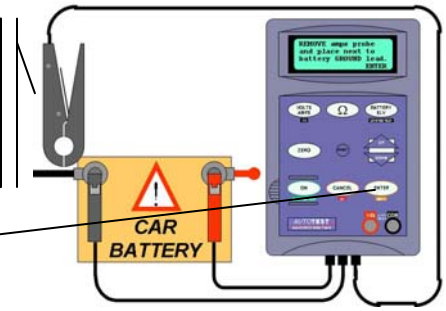
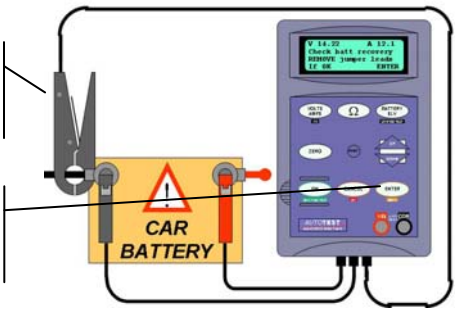


Finally, use the CANCEL button to complete the Managed Test and to return the Home Screen.

In the Home Screen, you can do any of the following:

1. Press CANCEL again to turn AutoTest off.
2. Press the Down button to view or print to the last Managed Test results again.

7.8. AutoTest Managed Test - Drain test when battery is too discharged

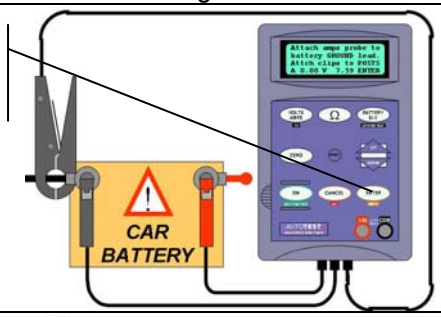
Directions	Screens and Explanations
1) Press the Enter button. 	If the battery did not have enough charge for AutoTest to carry out a reliable key-off current drain test in the earlier steps, the following screen appears: **Vch 14.65 Amps 1.23** **Drain test** **Stop motor ONLY** **if OK. ENTER** In this case: Leave the motor running and stop it only when Vch and Amps are adequate to re-start the vehicle and support normal driving. **Note:** a drained battery may initially accept very little charge when jump starting yet, 10 or 15 minutes later, will readily accept a higher, useful amount of charge.
2) Remove Amps Probe and hold it next to negative battery cable Amps probe arrow pointing toward the battery. 3) Press the Enter button. 	When you've stopped the motor, press **ENTER** to begin the drain test. The following screen appears: **REMOVE amps probe** **and place next to** **battery GROUND lead** **ENTER** 1. Hold the amps probe in the next-to position beside the battery ground lead. 2. Press **ENTER.**
4) Attach Amps probe to battery cable. 5) Press the Enter button. 	**Attach amps probe to** **battery GROUND lead** **Amps 0.52 ENTER** 1. Move the amps probe to the attached position. 2. Press **ENTER** to complete the Managed Test. **3. Go back to 9) of the sub-section 7.6 of the *Dynamic Tests (Step 3)*.**

7.9. AutoTest Managed Test - High Resistance Tests

AutoTest re-tests for high resistance and responds in one of three ways.

1-Battery is OK

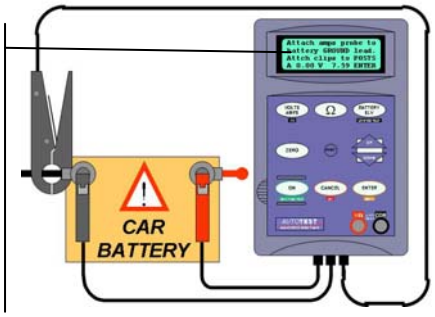
Press Enter, and go to the Dynamic tests.



If all is well, AutoTest goes straight to the dynamic tests. Go back to the **sub-section 7.6 *Dynamic Test section (Step 3)*** and follow the procedure.

2-Battery Rejected

Do not try jump starting because of the possibility of causing significant damage to sensitive components of the vehicle's electrical system.



If AutoTest determines that the battery still exhibits high resistance and is irrecoverable (incapable of accepting charge), the following screen appears:

Battery REJECTED
High Resistance

DO NOT JUMP START

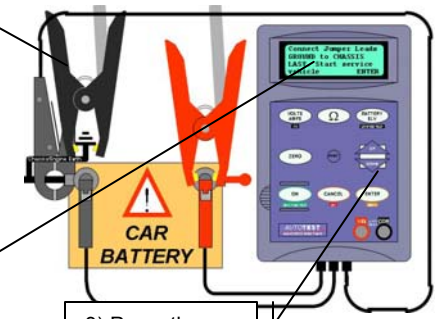
In this case:
1. Press **CANCEL** to stop the test (AutoTest returns to the Home Screen).
2. Inform the client that a new battery is required.

Do *not* try jump starting because of the possibility of causing significant damage to sensitive components of the vehicle's electrical system.

3-battery still exhibits high resistance

1) Connect positive Jumper leads to positive battery terminal and negative to **chassis last.**

2) Start service or connect your jump back vehicle **only!**



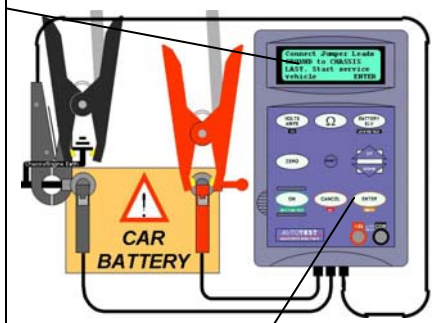
3) Press the Enter button.

If AutoTest determines that the battery still exhibits high resistance but may be recoverable (capable of accepting charge), the following screen appears:

Connect Jumper leads
GROUND to CHASSIS,
LAST. Start service
vehicle. ENTER

In this case:
1. Connect jumper leads from your service vehicle (or booster pack) to the test vehicle (follow standard operating procedure).
2. Start the service vehicle so that the test battery is receiving adequate charge. **DO NOT START THE DISABLED VEHICLE!**
3. Press **ENTER**.

4) AutoTest carries out a short test to determine if the battery is capable of accepting charge and reminds you not to start the DISABLED vehicle's motor. The test time remaining is shown (in minutes and seconds) in the lower right corner of the screen.



5) Press the Enter button.

Testing battery.
Do not start motor.
Vch 14.44 Amps 23.4
Please wait 0:20

If the battery accepts charge, AutoTest prompts you to stop the service vehicle and start the test vehicle (jumper leads still connected).

STOP service vehicle
Start TEST vehicle
Amps 24.5 ENTER

At this point press the Enter button, AutoTest will resume the Dynamic test. **Go back to 4) of the sub-section 7.6 *Dynamic Tests (Step 3).***

If AutoTest determines that the battery is irrecoverable (incapable of accepting charge), the following screen appears:

Battery REJECTED
High Resistance
DO NOT JUMP START

In this case, press **CANCEL** to stop the test (AutoTest returns to the Home Screen) and Inform the client that a new battery is required.

7.10. Possible battery test results from the Managed Test

Corroded Terminals Clean and Retest

The SLV between the Posts and the Clamps is more than 0.4 V different. This means that there will be a significant voltage drop between the Clamp and the Post during cranking which may cause starting problems. The poor clamp to post connection needs to be rectified i.e. clamps removed and posts and inside of clamps cleaned. Once cleaned, the vehicle needs to be retested.

Replace. Suspected Shorted Cell

The battery is not fit for further service. There is a short across at least one cell that will discharge the cell and render the battery useless. This was a common fault in the past but modern batteries tend to have the positive plates enveloped in a polyethylene material to prevent material shedding and shorts.

Replace. Inter-cell Fault

The battery is not fit for further service. This message occurs when a battery is accepting charge but its condition is not improving. It means the battery has a gross internal fault.

Replace. High Resistance

The battery is not fit for service. This message occurs when a battery has a very high internal resistance. It usually means there is a cracked weld or a fractured connection in the battery. Therefore, there is no proper current path within the battery.

Pass

The battery is OK. Its SLV is above 9.9 Volts and its rating is above 30%.

Marginal

The battery is OK but marginal. Its SLV is between 9.6 and 9.9 Volts and its battery rating is between 0% and 30%.

Pass/Charge

The battery is OK but it requires further charge. When a battery is very discharged the battery rating % is not given because its accuracy diminishes with state of charge.

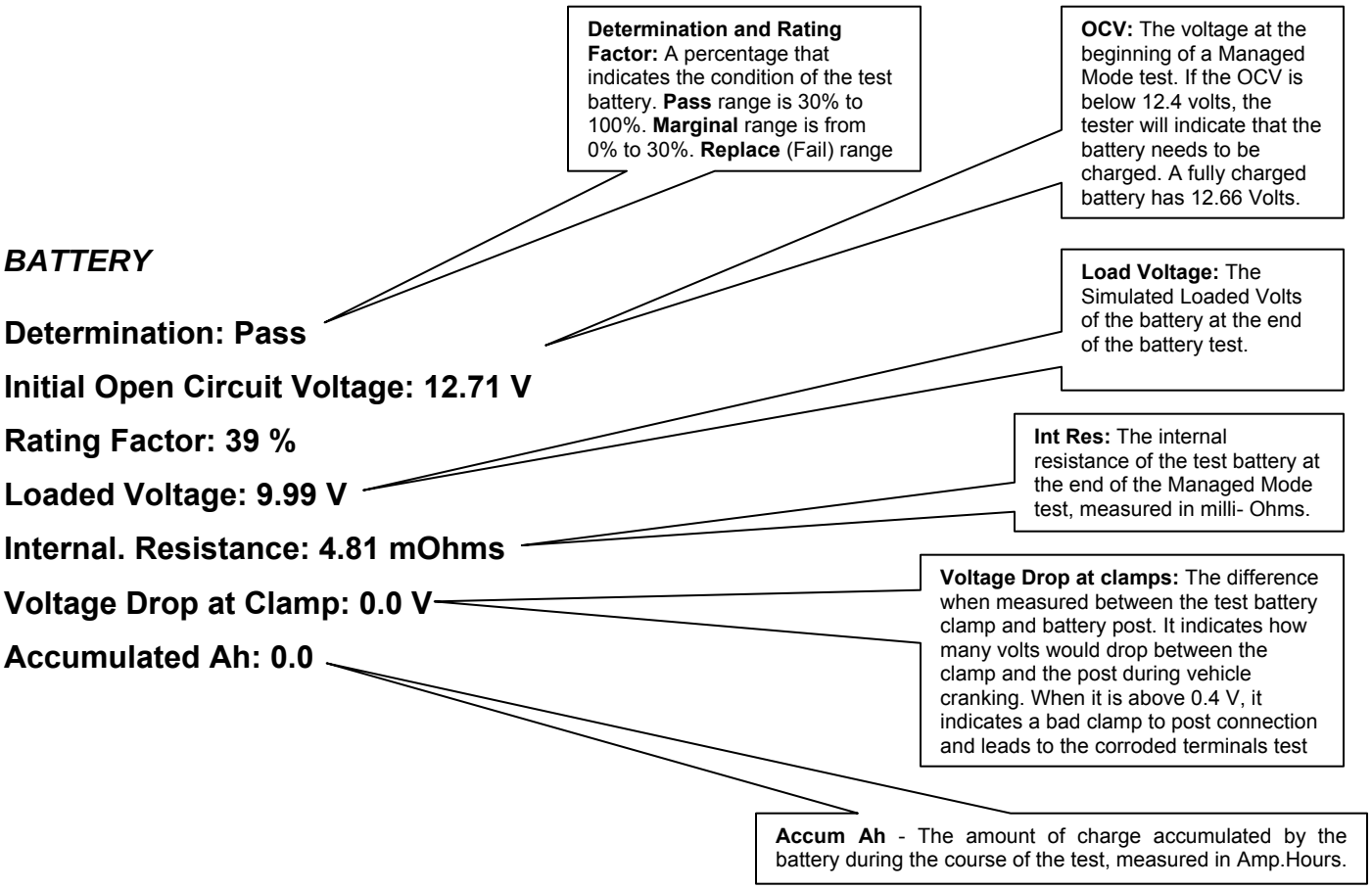
Replace

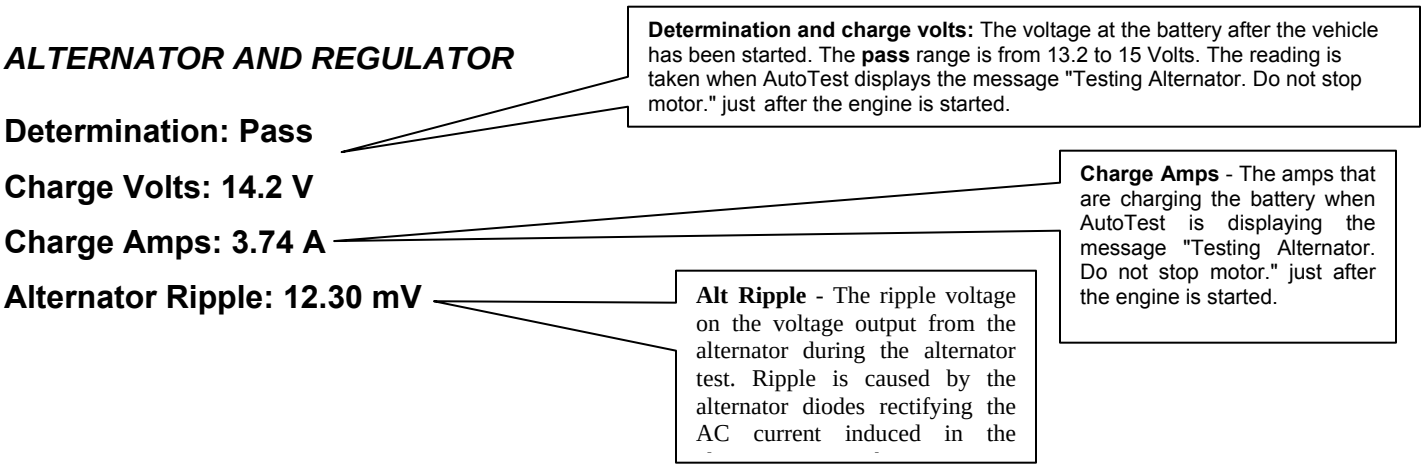
The battery is not fit for service and should be replaced. For a well-charged battery this means the SLV is below 9.6 volts and the battery rating is below 0%. For a discharged battery these values can change depending on the original state of charge of the battery. The lower the SLV or the more negative the battery rating % the worse the battery.

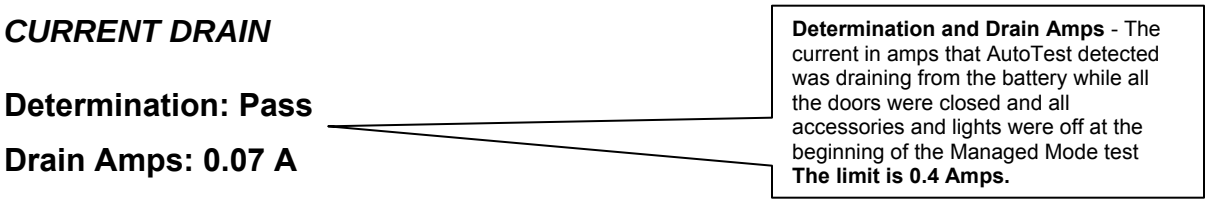
Charge Manually

This message appears at the bottom of the results screen when it is determined that the battery being tested is OK but very discharged. It prompts the operator to advise the customer that their battery should be completely recharged on an external battery charger as soon as possible.

7.11. AutoTest Managed Test Results Analysis


BATTERY
Determination: Pass
Initial Open Circuit Voltage: 12.71 V
Rating Factor: 39 %
Loaded Voltage: 9.99 V
Internal. Resistance: 4.81 mOhms
Voltage Drop at Clamp: 0.0 V
Accumulated Ah: 0.0
Determination and Rating Factor: A percentage that indicates the condition of the test battery. **Pass** range is 30% to 100%. **Marginal** range is from 0% to 30%. **Replace** (Fail) range
OCV: The voltage at the beginning of a Managed Mode test. If the OCV is below 12.4 volts, the tester will indicate that the battery needs to be charged. A fully charged battery has 12.66 Volts.
Load Voltage: The Simulated Loaded Volts of the battery at the end of the battery test.
Int Res: The internal resistance of the test battery at the end of the Managed Mode test, measured in milli- Ohms.
Voltage Drop at clamps: The difference when measured between the test battery clamp and battery post. It indicates how many volts would drop between the clamp and the post during vehicle cranking. When it is above 0.4 V, it indicates a bad clamp to post connection and leads to the corroded terminals test
Accum Ah - The amount of charge accumulated by the battery during the course of the test, measured in Amp.Hours.


ALTERNATOR AND REGULATOR
Determination: Pass
Charge Volts: 14.2 V
Charge Amps: 3.74 A
Alternator Ripple: 12.30 mV
Determination and charge volts: The voltage at the battery after the vehicle has been started. The **pass** range is from 13.2 to 15 Volts. The reading is taken when AutoTest displays the message "Testing Alternator. Do not stop motor." just after the engine is started.
Charge Amps - The amps that are charging the battery when AutoTest is displaying the message "Testing Alternator. Do not stop motor." just after the engine is started.
Alt Ripple - The ripple voltage on the voltage output from the alternator during the alternator test. Ripple is caused by the alternator diodes rectifying the AC current induced in the


CURRENT DRAIN
Determination: Pass
Drain Amps: 0.07 A
Determination and Drain Amps - The current in amps that AutoTest detected was draining from the battery while all the doors were closed and all accessories and lights were off at the beginning of the Managed Mode test **The limit is 0.4 Amps.**

7.12. AutoTest Managed Test Parameters

These are the parameters that will determine the pass, failure or suspect state of the electrical system components.

OCV (Open Circuit Voltage)

Battery doesn't need charge = 12.4 V to 12 .66 V
Battery needs charge = Less than 12.4 V

LV (Load Voltage) (As determined by the Battery Council International-BCI)

Battery Pass 9.91 V to 10.6 V (31% to 100 % Rating)	**Battery Marginal** 9.6 V to 9.9 V (0% to 30 % Rating**)**	**Battery Fail** Less than 9.6 V (Under 0% Rating)
10.6 V = 100 % 10.5 V = 90 % 10.4 V = 80 % 10.3 V = 70 % 10.2 V = 60 % 10.1 V = 50 % 10 V = 40 % 9.91 V = 31 %	9.9 V = 30% 9.8 V = 20 % 9.7 V = 10 % 9.6 V = 0 %	9.5 V = - 10 % 9.4 V = - 20 % 9.3 V = - 30 % 9.2 V = - 40 % 9.1 V = - 50 % 8.6 V = -100 %

Charging voltage (Alternator/Regulator)

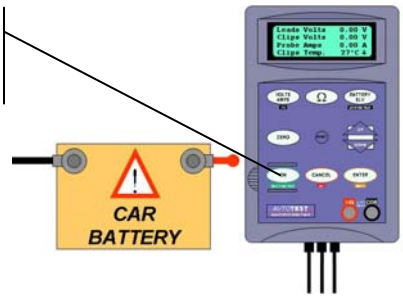
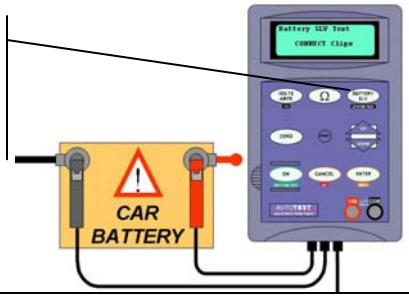
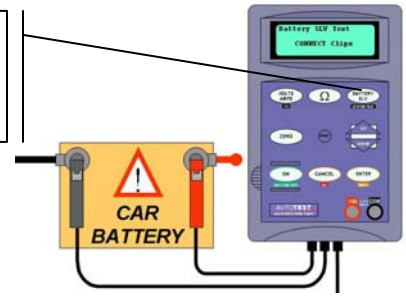
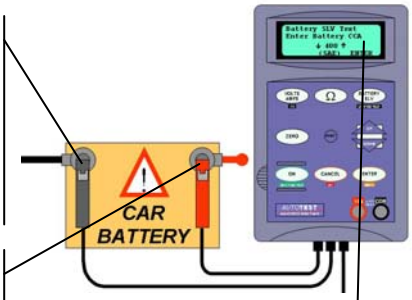
Alternator/regulator pass = 13.2 V to 15 V
Alternator/regulator suspect = Less than 13.2 V
Alternator/regulator suspect = More than 15 V

Drain current/amps (DA)

Drain pass = O.4 Amps and Less
Drain Suspect = More than 0.4 Amps

8. AutoTest Starter Motor Testing Procedure

The starter cranking test requires that the test clips be connected to the battery posts, and that the amps probe is "Attached" to the battery ground lead. AutoTest prompts the operator through the test.

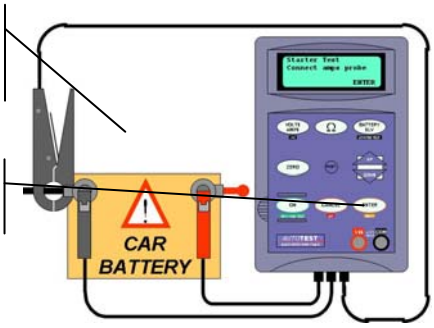
Directions	Screens and Explanations
1) Press the "ON" button to turn the tester "ON" . 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C ↓** This screen is known as the "Home Screen" because it is **4.** AutoTest's startup screen **5.** the base for all Measurement Mode selections **6.** the entry screen to Menu Mode
2) Press the "Battery SLV" button to begin the test. 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C ↓**
3) Do not connect the clips. Press the "Battery SLV" button to begin again. 	AutoTest prompts you to connect the test clips. **Battery SLV Test** **CONNECT Clips** Press the **Battery SLV** button again to enter the **Starter test**.
4) Connect the test clips to the battery posts — black clip to the negative post, red clip to the positive post. 5) Make sure that the upper/longer jaw of each test clip makes direct contact with the battery ***post.*** 6) When AutoTest detects that the test clips are connected to the battery, the connect amps probe screen will appear. 	**Starter Test** **CONNECT Clips** AutoTest still prompts you to connect the test clips but it also indicates you are in the Starter Test. Further presses of the **BATTERY SLV** button will toggle between the SLV Test and the Starter Test connect clips prompt screen. 1. Connect the test clips to the battery posts — black clip to the negative post, red clip to the positive post. AutoTest will prompt you for reconnection if the test clips are connected with reverse polarity. 2. Make sure that the upper/longer jaw of each test clip makes direct contact with the battery ***post***, not just with the battery clamp that surrounds the post. 3. When AutoTest detects that the test clips are connected to the battery, the connect amps probe screen will appear.

Directions

Screens and Explanations

7) Attach the Amps Probe.

8) Press the Enter button.

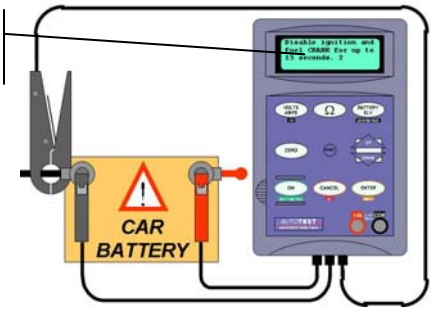


Starter Test
Connect amps probe

ENTER

Using the correct procedure, clamp the amps probe around the battery cable ("Attached" position) and press the **ENTER** button.

9) Follow the instructions.



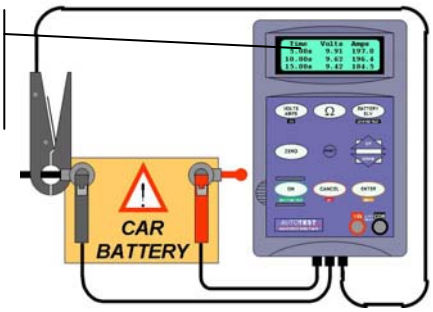
AutoTest prompts you for the next step:

Disable Ignition and
Fuel and Crank for up
to 15 seconds.

15 sec

Disable the vehicle's ignition and fuel (so the engine can not run when the starter is activated) in an approved manner. It is important to disable the fuel as well as the ignition to prevent unburnt fuel entering the vehicle's catalytic converter and exhaust system.

10) Upon completion, read the test results.



Operate the starter, ideally up to a maximum of fifteen seconds. The cranking time is shown in the bottom of the screen (counts down from 15 seconds).

AutoTest measures the cranking voltage and current after every 5 seconds until 15 seconds have elapsed.

You may stop cranking at any point during the 15 second (recommended) test. If you stop cranking short of 15 seconds AutoTest will record the cranking voltage and current after 5 and/or 10 seconds (depending on how long the engine has been cranked for) and at the time just before cranking was stopped.
When cranking has stopped, AutoTest displays the test results in three rows:

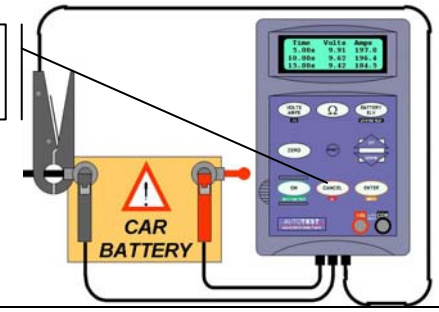
Time	Volts	Amps
5.0 s	11.9	220.0
10.0 s	11.0	241.1
15.0 s	10.1	244.4

Where:

Volts = The cranking voltage at the time indicated in the left-hand column. Times will be 5, 10 and 15 seconds if cranking occurred for the full 15 seconds.

Amps = The cranking amps at the time indicated in the left-hand column. Times will be 5, 10 and 15 seconds if cranking was for the full 15 seconds.

11) Press Cancel to return to the Home Screen.



Press the **CANCEL** button to return to the Home Screen.

9. AutoTest Measurement/Multimeter Mode

This section takes you step-by-step through AutoTest's Measurement Mode.

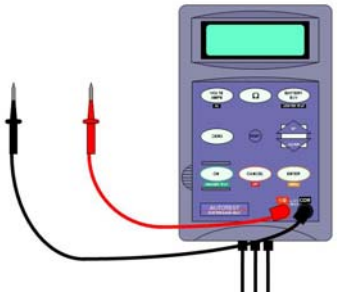
Measurement Mode, provides for the followings, are all controlled by the operator:

- conventional DC multimetering (volts, amps, ohms)
- AC measurements including frequency pulse width and duty cycle
- voltage drop across a diode

As in conventional multimetering tasks, the application and interpretation of Measurement Mode tests is the responsibility of the operator.

Test Leads

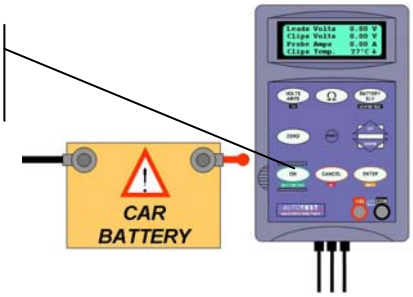
The following table shows the test leads used for each measurement.



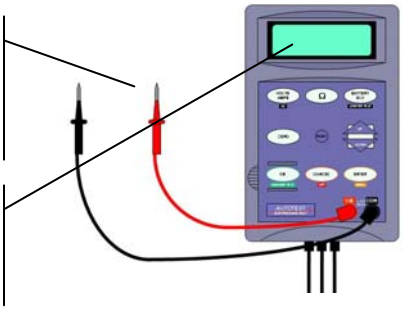
To Measure	Use
DC volts	multimeter test leads (plug in to the front panel)
Ohms	multimeter test leads
AC volts	multimeter test leads
DC amps	amps probe

When using the pair of multimeter test leads, make sure they are plugged into the correct sockets in the lower right-hand corner of AutoTest's front panel — red lead to the VΩ socket and black lead to the COM socket.

9.2. How to turn the AutoTest ON

Directions	Screens and Explanations
Press the "ON" button to turn the tester "ON" . 	**Leads Volts 0.00 V** **Clips Volts 0.00 V** **Probe Amps 0.00 A** **Clips Temp. 20°C ↓** This screen is known as the "Home Screen" because it is 1. AutoTest's startup screen 2. the base for all Measurement Mode selections 3. the entry screen to Menu Mode

9.3. Measuring DC Volts

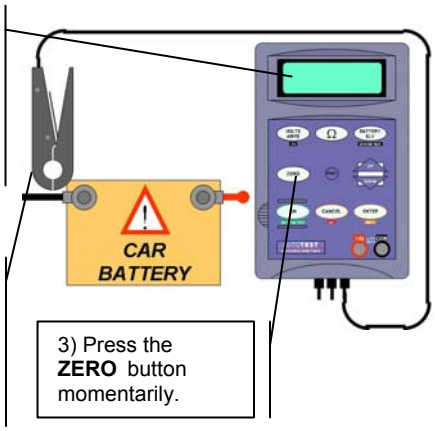
1) Hold the multimeter probes against the points to be tested (as with a conventional 2) The reading appears on the Home Screen by leads volts. 	Hold the multimeter probes against the points to be tested (as with a conventional multimeter). AutoTest displays the reading beside **Leads Volts** in the Home Screen. It is also possible to use the negative test clip to establish a ground reference in Measurement Mode. Using the negative test in Measurement Mode means voltage readings can be taken handling only the positive test lead, a real advantage in cramped conditions. **Leads Volts 12.30 V** Clips Volts 0.00 V Probe Amps 0.00 A Clips Temp. 20°C ↓

9.4. Measuring DC Amps

You can also use the amps probe as a stand alone current measuring tool to measure the current coming out (drain) of the battery when the engine is not running.

1) Observe the **Probe Amps** initial reading. This has to be reset to zero to establish the point of reference.

2) Hold Amps Probe next to negative battery cable Amps probe arrow pointing toward the battery.



3) Press the **ZERO** button momentarily.

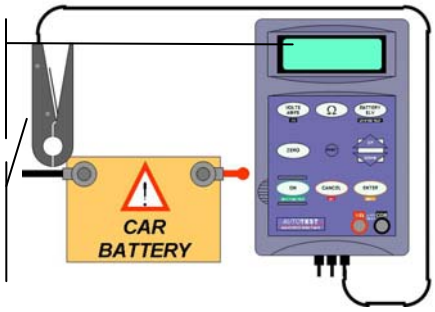
In AutoTest's Home Screen:

1. Observe the **Probe Amps** initial reading. This has to be reset to **zero** to establish the point of reference. It is presently at 1.17 A.
2. Hold the amps probe in the next-to position (see "Using the Amps Probe Correctly" earlier in this manual) relative to the cable being measured. Hold it in place steady with the Amps probe arrow pointing toward the battery.
3. Press the **ZERO** button momentarily.

Leads Volts	0.00 V
Clips Volts	0.00 V
Probe Amps	**1.17 A**
Clips Temp.	20°C ↓

4) Observe the **Probe Amps** reading. It must be now at zero.

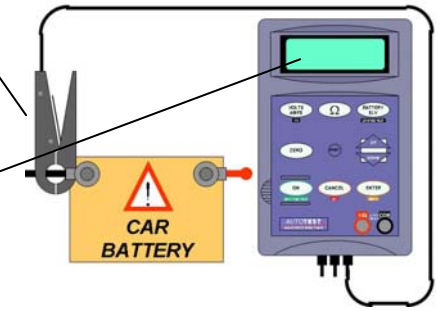
5) Keep holding your Amps probe in the same next to postion.



Leads Volts	0.00 V
Clips Volts	0.00 V
Probe Amps	**0.00 A**
Clips Temp.	20°C ↓

6) Attach Amps probe to battery cable.

7) This is you current parasitic drain.



AutoTest displays the current reading beside **Probe Amps** in the Home Screen. For this situation it is **0.53 Amps**.

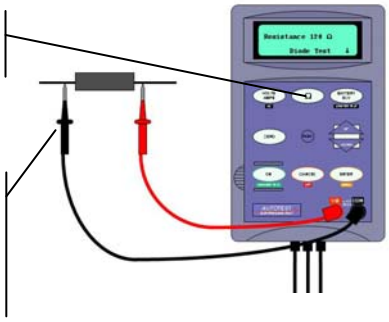
Leads Volts	0.00 V
Clips Volts	0.00 V
Probe Amps	**0.53 A**
Clips Temp.	20°C ↓

Important: Attached the Amps Probe in the same position as the next to position and hold it there for an accurate reading.

9.5. Measuring Resistance (Ohms)

1) Press the Ω button.

2) Hold the multimeter test lead probes against the points to be tested.



From the Home Screen, press the Ω button.

The display shows :

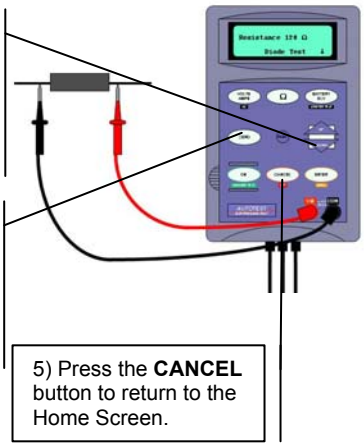
Resistance	**=> 5M Ω**
	)) OFF ↑
	Diode Test↓

Hold the multimeter test lead probes against the points to be tested.

Note: AutoTest can measure resistance from 0 to 4.9 Mega ohms, auto-ranging. The resistance measurement circuitry is protected against connection to voltages of ±40V DC, however, resistance measurements will not be valid when measuring components in a live circuit.

3) Press the up arrow to disable the continuity beep function. Pressing the up arrow again will re-enable the continuity beep function.

4) Press the zero button to measure the relative resistance. This measures the resistance of one component relative to another.



5) Press the **CANCEL** button to return to the Home Screen.

To aid continuity testing the analyzer can emit a continuous beep if the resistance is less than five ohms for more than half a second.

Press the up arrow to disable the continuity beep function. Pressing the up arrow again will re-enable the continuity beep function.

Resistance	**=> 5M Ω**
	)) ON ↑
	Diode Test↓

Press the zero button to measure the relative resistance. This measures the resistance of one component relative to another.

For instance, if your multimeter leads were slightly corroded you could join the leads and press the zero button to measure the relative resistance. Then the readings you take will be the resistance of the component you are measuring without being influenced by the resistance of your corroded leads.

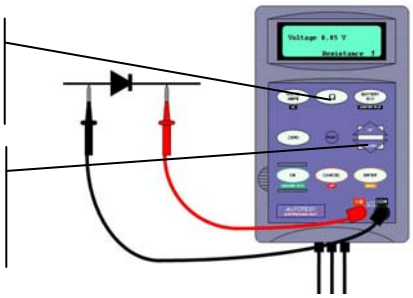
Pressing the zero button again returns to normal resistance measuring readings.

9.6. Measuring Diode Volts

Diode voltage is measured using the multimeter test leads. When measurements are made ensure the test diode is *not* part of a live circuit. AutoTest measures diode voltage by supplying the diode with a calibrated current source through the multimeter test leads. If the component is accepting current from another source, the diode voltage measurement made by AutoTest may not be valid.

1) From the Home Screen, press the Ω button.

2) Press the **DOWN** button to access the diode test screen



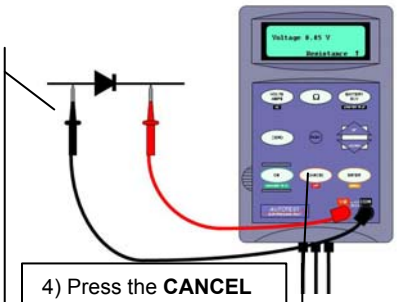
From the Home Screen, press the Ω button.

The display shows:

Resistance	**=> 5MΩ**
	)) OFF ↑
	Diode Test ↓

Press the **DOWN** button to access the diode test screen.

3) Hold the negative test probe against the lead from the banded end of the diode and the positive test probe against the other. The voltage drop across the diode is displayed.



4) Press the **CANCEL** button to return to the Home Screen or press the **UP** button to return to the resistance measurement screen.

The display shows:

Voltage x.xx	
	Resistance ↓

Hold the negative test probe against the lead from the banded end of the diode and the positive test probe against the other. The voltage drop across the diode is displayed.

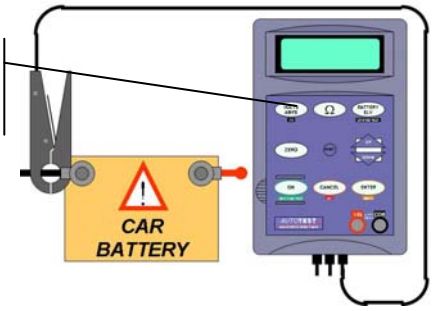
It is important to note that a diode is not a linear device. In other words it displays different characteristics when measured in different ways. If no voltage is displayed (x.xx remains as the reading) when the test probes are put across the diode then try reversing the test probes.

If the voltage display remains as x.xx or is a reading which is outside the specifications of the diode being tested then the component is faulty.

9.7. Measuring Engine RPM

AutoTest can measure engine RPM by sensing the current fluctuations caused by the engine's ignition coil using the Amps Probe. When a vehicle is not fitted with fuel injectors this current fluctuation can be measured directly from the battery cable. If, however, the vehicle has electronic fuel injectors, they can create too much "noise" on the battery cable current signal and in such vehicles it is recommended that the Amps Probe be clamped around the low-tension wire from the battery to the coil to make RPM readings.

1) From the Home Screen, press the Ω button twice.



From the Home Screen, press the Ω button twice.

The display shows the engine RPM Screen:

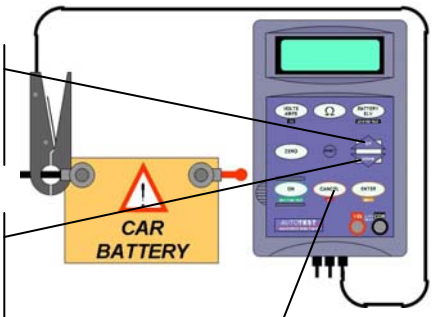
Cyls: 6↓	**R/Sprk: 2↓**
RPM 750	**Dwell 36°**
Pulse 16.1 mS	
Pulses/minute 2250	

The definitions of the data displayed in the Engine RPM Screen are shown below:

Cyls	the number of cylinders in the engine of the test vehicle.
R/Sprk	the cylinder Revolutions per Spark. For most distributorless ignition systems or for 2 stroke engines this is equal to 1. For normal 4 stoke engines the revolutions per spark equals 2.
Dwell	the number of degrees of distributor rotation for which the distributor points remain open.
Pulse	The time (in milliseconds) that the distributor points remains open.
Pulses/minute	the total number of current pulses detected per minute.

2) Use the **UP** button to choose the number of cylinders in the engine of the test vehicle.

3) Use the **DOWN** button to choose one or two revolutions per spark.



4) Press the **CANCEL** button to return to the Home Screen revolutions per spark.

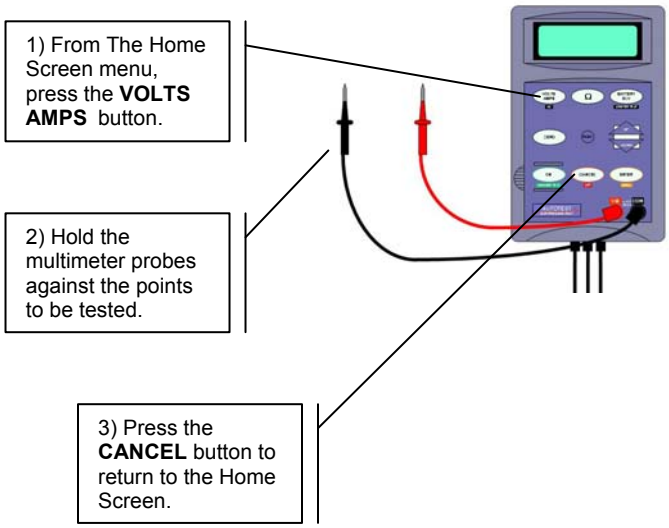
Use the **UP** button to choose the number of cylinders in the engine of the test vehicle. Repeated presses of the **UP** arrow will increase the number of cylinders up to twelve. The next press of the **UP** arrow from twelve will go back to one cylinder.

Use the **DOWN** button to choose one or two revolutions per spark. Normal 4 stroke engines fire one spark every 4 cylinder strokes which is one spark every for every two engine revolutions. Most distributorless ignition systems on four stroke engines fire a spark on each cylinder's exhaust and power strokes which means they fire two sparks every 4 strokes or two sparks every two engine revolutions. Two stroke engines fire one spark every engine revolution.

The following table shows various engine types and the revolutions per spark for each type.

Engine Type	Revolutions per Spark (R/Spk)
Normal 4 Stroke	2
4 Stroke / Distributorless Ignition	1
Two Stroke	1
Diesel	Not Suitable for RPM Measurement using Amps Probe

AutoTest can display the characteristics of a varying voltage signal by using the multimeter test leads and the AC Volts screen.
In AutoTest's Home Screen :


1) From The Home Screen menu, press the **VOLTS AMPS** button.
2) Hold the multimeter probes against the points to be tested.
3) Press the **CANCEL** button to return to the Home Screen.

From The Home Screen menu, press the VOLTS AMPS button.

Hold the multimeter probes against the points to be tested.

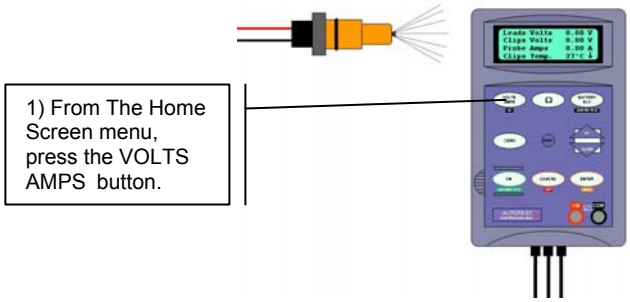
AutoTest displays the measurements in the AC Volts screen:

DC 9.10 AC	**4.22 V**
Pk–Pk Volts	**7.18 V**
Duty 98%	**2.8 mS**
Frequency	**6.1KHz ↓**

AutoTest treats the signal being measured as being made up of two components: a DC offset voltage with an alternating voltage superimposed onto it. AutoTest separates these two voltage components and displays them together in the AC Volts screen shown above. The characteristics of the voltage input signal which are measured by AutoTest are:

DC	the DC component of the signal being measured.
AC Volts	the true Root Mean Square (RMS) AC voltage component of the signal being measured.
Duty	the positive duty cycle (%) for the voltage signal being measured.
Pulse Width	the value displayed to the right of the duty cycle and is the "on" time of the signal being measured.
Frequency	the frequency of the AC waveform in cycles per second (Hz).

9.8. Fuel Injector Test



From The Home Screen menu, press the VOLTS AMPS button.

Hold the multimeter probes against the points to be tested.

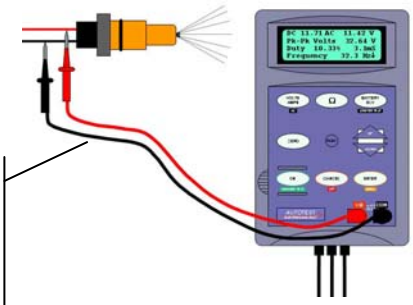
AutoTest displays the measurements in the AC Volts screen:

DC 9.10 AC	**4.22 V**
Pk–Pk Volts	**7.18 V**
Duty 98%	**2.8 mS**
Frequency	**6.1KHz↓**

AutoTest treats the signal being measured as being made up of two components: a DC offset voltage with an alternating voltage superimposed onto it. AutoTest separates these two voltage components and displays them together in the AC Volts screen shown above. The characteristics of the voltage input signal which are measured by AutoTest are:

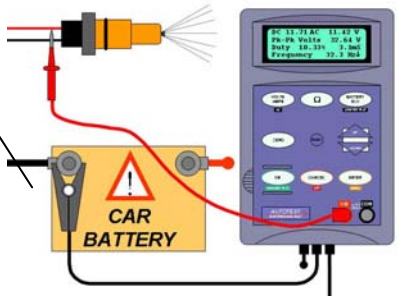
DC	the DC component of the signal being measured.
AC Volts	the true Root Mean Square (RMS) AC voltage component of the signal being measured.
Duty	the positive duty cycle (%) for the voltage signal being measured.
Pulse Width	the value displayed to the right of the duty cycle and is the "on" time of the signal being measured.
Frequency	the frequency of the AC waveform in cycles per second (Hz).

2) Hold the test leads on the fuel injector positive and negative points of connection.

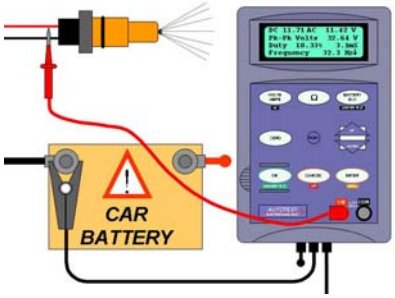


DC 11.71 AC 11.42 V
Pk-Pk Volts 32.64 V
Duty 10.33% 3.10mS
Frequency 32.3 Hz ↓

3) Hold the positive test lead on the fuel injector positive and use the battery negative terminal as the ground.



DC 2.51 AC 11.42 V
Pk-Pk Volts 32.64 V
Duty 10.33% 3.10mS
Frequency 32.3 Hz ↓



DC 11.71 AC 11.42 V
Pk-Pk Volts 32.64 V
Duty 10.33% 3.10mS
Frequency 32.3 Hz ↓

DC 6.08 AC 6.08 V
Pk-Pk Volts 32.64 V
Duty 10.33% 3.10mS
Frequency 32.3 Hz ↓

DC 11.71 AC 11.42 V
Pk-Pk Volts 32.64 V
Duty 10.33% 3.10mS
Frequency 32.3 Hz ↓

DC 11.68 AC 11.39 V
Pk-Pk Volts 24.44 V
Duty 10.33% 3.10mS
Frequency 32.3 Hz ↓

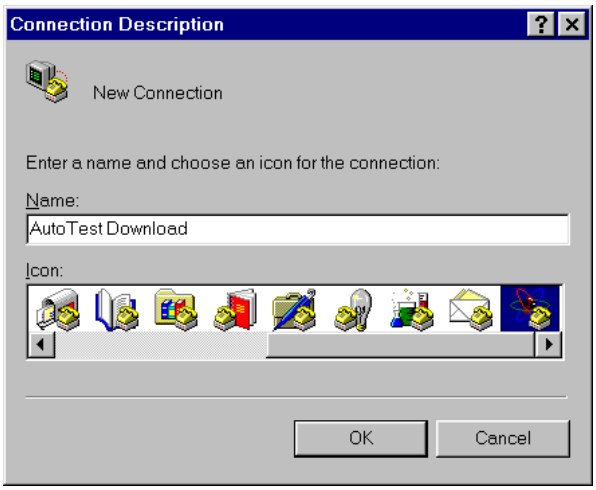
DC 9.83 AC 9.54 V
Pk-Pk Volts 32.64 V
Duty 22.59% 6.79mS
Frequency 32.3 Hz ↓

DC 11.71 AC 11.42 V
Pk-Pk Volts 32.64 V
Duty 10.33% 3.10mS
Frequency 60.0 Hz ↓

	DC 11.71 AC 11.42 V Pk-Pk Volts 32.64 V Duty 10.33% 3.10mS Frequency 32.3 Hz ↓
	Pulse 27.0 3.1mS Duty 89.7% 10.3% RPM 1935 RPM2 3871 Frequency 32.3Hz

10. Importing AutoTest Data into an Excel® Spreadsheet

1. Open HyperTerminal, a standard communications program that ships with Windows XP®, Windows 2000®, Windows Me®, Windows98® Windows95® and Windows3.11®. If the **HyperTerminal** program isn't loaded on your computer then go to the Control Panel and double click on **Add/Remove Programs**, next choose the **Windows Setup** tab, then choose **Communications** and click on the **Details** button. Ensure there is a tick next to the **HyperTerminal** option, if not tick it now and click on OK, then follow the instructions to load the **HyperTerminal** program. In Windows, **HyperTerminal** is usually found by pressing the **Start** button then **Programs** then **Accessories** and finally **HyperTerminal**. This opens the HyperTerminal folder. Next double click on **Hypertrm** to launch the program.
2. Set up the terminal settings for AutoTest. The HyperTerminal dialog boxes are biased toward communications via a modem but we are going to set up direct communications through Com Port 1.



a) Select **File**, then **New Connection** and the following screen appears.

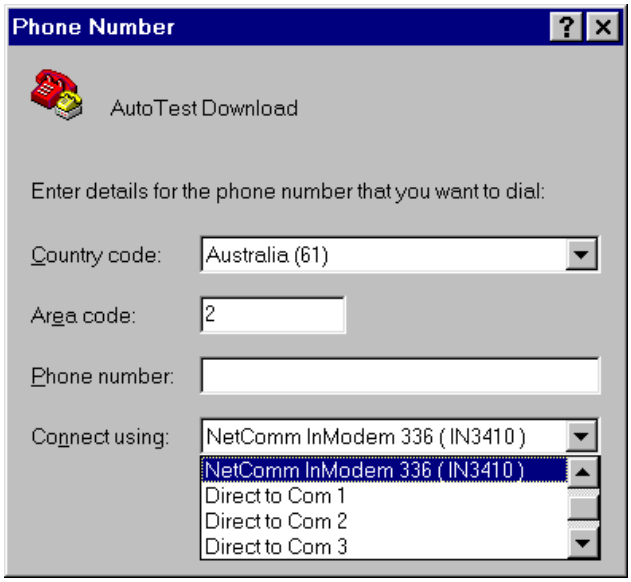
Give your new connection a name like "AutoTest Download" and choose an icon.

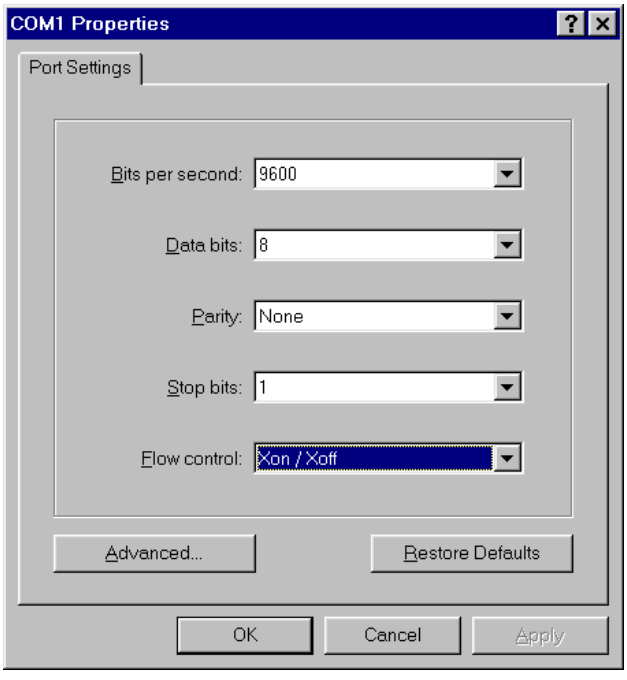
Then choose **OK.**

b) the next screen that appears has a whole lot of settings for phone numbers etc as shown below:

By selecting the drop down arrow that is next to the "Connect using:" box you get a choice of connecting via a modem or directly to a Com Port. Choose to connect directly to a spare Com Port say Com Port 1. Then select **OK**.

Notice that the phone number options become "grayed out" when the direct com port selection is made.





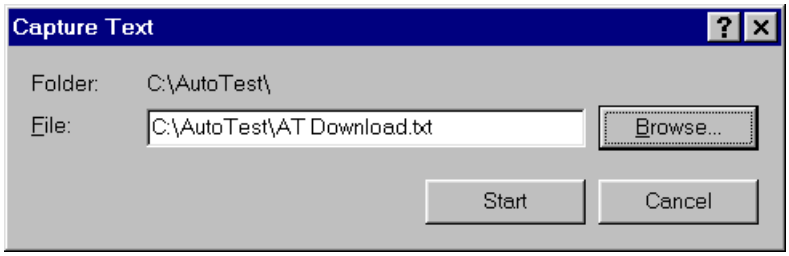
c) Now we have selected where the data is going we have to tell HyperTerminal what format it is coming in. AutoTest communicates at 9600 baud (earlier versions of AutoTest V3.00 to V3.28 communicate at 1200 baud). The other communications settings as shown in the diagram below are:

9600 bits per second, 8 data bits, with one stop bit, no parity and Xon – Xoff flow control.

We now have a HyperTerminal terminal set up for AutoTest downloads.

3. To download data to the terminal that has been created we need to set up a suitable text file in which to store the downloaded data. Create a new text file called C:\autotest\AT Download.txt.

   a) From the HyperTerminal window choose **Transfer** then **Capture Text**. You will be prompted to select a file into which the captured text will be stored.



   b) Click on the **Browse** button and navigate to **AT Download.txt**. Then click **Start**.

   c) HyperTerminal is now ready to accept downloaded data from AutoTest.

4. Connect AutoTest to the PC by connecting the "Transfer data cable" (9 pin female connector to PS2 connector) from Com port 1 of the computer (or whatever Com port HyperTerminal has been set up for) to the coms port in AutoTest. The AutoTest Coms port is located at the bottom of the tester, to the left-hand side of the leads, under a rubber protective seal.

5. To send the data to HyperTerminal we must select **Download Results** from AutoTest's Menu Options.

   a) To enter the menu screens press the **ENTER (Menu)** button from AutoTest's home screen and scroll down until you reached "Download Last Test Results" (see below):

1 (Press Enter)

```
Clips Volts      0.00 V
Leads Volts      0.00 V
Probe Amps       0.00 A
Clips Temp       20°C  ↓
```

2 (Scroll Down)

```
>1)Battery Life
 2)CCA Standard
 3)Backlight Default
 4)Language          ↓
```

3 (Press Enter)

```
>5)Download Results
 6)Print Results
 7)Clear Results
 8)Code Reader       ↓
```

4 (Scroll Up)

```
Download
Last Test Result
(↑↓ to select)
(Enter to Download)
```

At this point press the **down arrow**. The next screen will appear:

5

```
Download
ALL Test Results
(↑↓ to select)
(Enter to Download)
```

   b) From the last screen shown (5) press the **ENTER** button and AutoTest will begin downloading results. When it is completed a beep will be heard and the screen will return to the menu screen shown below.

```
>5)Download Results
 6)Print Results
 7)Clear Results
 8)Code Reader       ↓↑
```

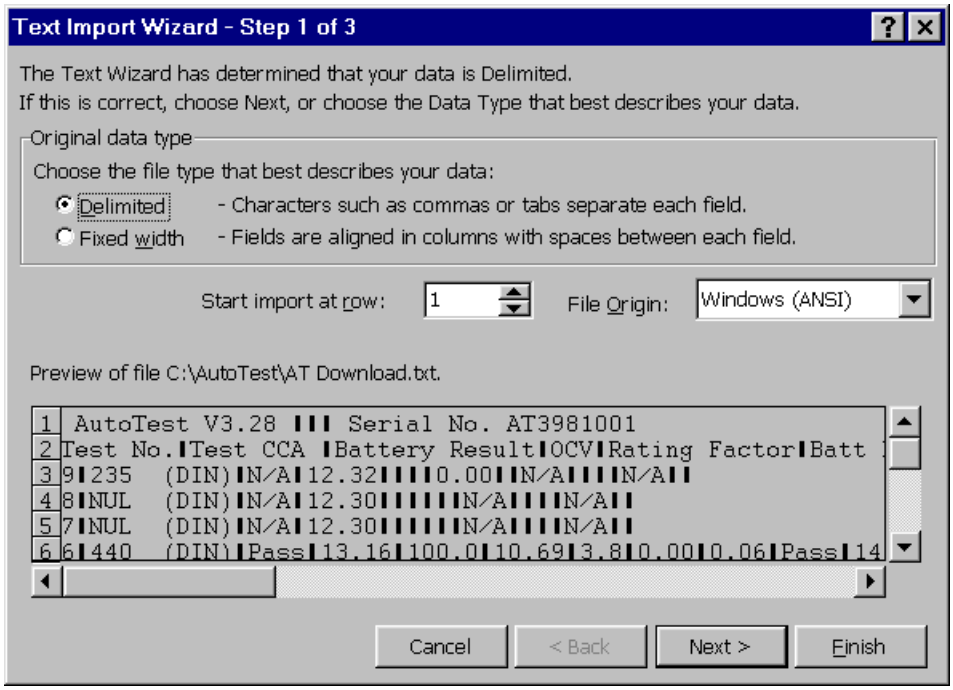
6. Now we need to tell the PC the download is completed. From the HyperTerminal window choose **Transfer** then **Capture Text** then **Stop**. This stops the download process at the PC end of things and makes the **AT Download.txt** file available for other programs.

7. Now we need to import the newly downloaded text file into an Excel® spreadsheet.

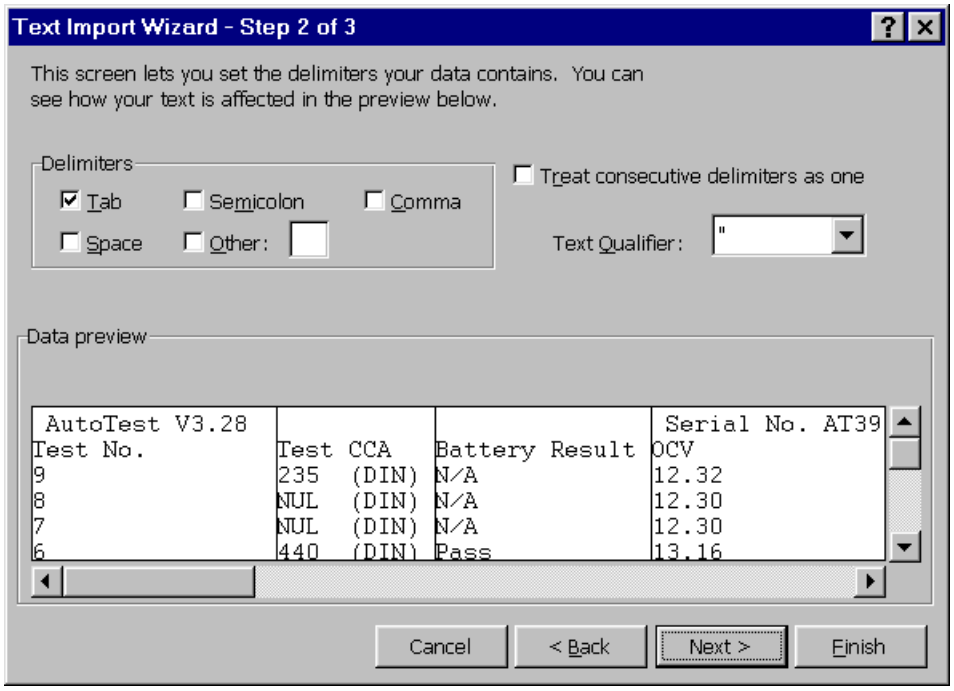
   a) Launch Excel®.

   b) Click the open file button and in the "Files of type:" choose "Text Files" from the drop down menu. Next navigate to **C:\autotest\AT Download.txt** and click **Open.**

c) Now the Text Import Wizard opens. The first dialog box is shown below:


Text Import Wizard - Step 1 of 3
The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the Data Type that best describes your data.
Original data type
Choose the file type that best describes your data:
Delimited - Characters such as commas or tabs separate each field.
Fixed width - Fields are aligned in columns with spaces between each field.
Start import at row: 1
File Origin: Windows (ANSI)
Preview of file C:\AutoTest\AT Download.txt.
1 AutoTest V3.28 Serial No. AT3981001
2 Test No. Test CCA Battery Result OCV Rating Factor Batt
3 9 235 (DIN) N/A 12.32 0.00 N/A N/A
4 8 NUL (DIN) N/A 12.30 N/A N/A
5 7 NUL (DIN) N/A 12.30 N/A N/A
6 6 440 (DIN) Pass 13.16 100.0 10.69 3.8 0.00 0.06 Pass 14
Cancel
< Back
Next >
Finish

d) The file downloaded from AutoTest is Tab delimited file so choose the options shown in the diagrams above then choose **Next** and then choose the options shown in the diagram below:


Text Import Wizard - Step 2 of 3
This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.
Delimiters
Tab
Semicolon
Comma
Space
Other:
Treat consecutive delimiters as one
Text Qualifier: "
Data preview
AutoTest V3.28 Serial No. AT39
Test No. Test CCA Battery Result OCV
9 235 (DIN) N/A 12.32
8 NUL (DIN) N/A 12.30
7 NUL (DIN) N/A 12.30
6 440 (DIN) Pass 13.16
Cancel
< Back
Next >
Finish

8. At this point simply choose **Finish** and you should have your data loaded into an Excel spreadsheet.

Once imported you can wrap the text in the headings row and use Auto Format to get a professionally presented table ready to be printed out.

11. AutoTest Technical Specifications

Language Capability

AutoTest's four line LCD display can be switched into one of 3 different languages. The default language is selected from the menu screen. Available languages are:

English	German	French

Physical Characteristics

Dimensions	210mm x 140mm x 40mm
Weight	1100g
Weather Sealing	Splash resistant non immersible
Impact Resistance	Can be dropped from 1metre onto concrete without damage (without protective cover)
Operating Temperature Range	
Wide Temperature Model	From -20°C to 70°C
Normal Temperature Model	From 0°C to 70°C
AutoTest plastic case	Heat distortion temperature 82°C, vical softening temperature 96°C
User Interface	
Liquid Crystal Display	20 Character, 4 Line with Backlight
LCD Contrast Control	Circuit board temperature sensor automatically adjusts LCD bias voltage for optimum contrast at all ambient temperatures
User Keypad	Membrane switch type with phosphorescent buttons for ease of use at night or in poor lighting conditions

Electrical Characteristics

Absolute Maximum Input Voltages	
Test Clips	±23 Volts (Surge protection devices start to conduct at 24 Volts)
Multimeter Leads	±40 Volts
Surge Protection	
Test Clips	80 Volt for 400mS (standard automotive load dump specification)
Multimeter Leads	Metal Oxide Varistor protected
Power Consumption (Typical)	
Without LCD Backlight	99mA
With LCD Backlight	128mA
Standby Power Consumption	200μA with Real Time Clock disabled 2mA with Real Time Clock enabled
Typical Run Time (New Fully Charged Battery)	8 Hours with backlight off 6.0 Hours with backlight on
Typical Shelf Life (New Fully Charged Battery)	200 days with AutoTest switched off and Real Time Clock Disabled 20 days with AutoTest switched off and Real Time Clock Enabled

Multimeter Specifications

Resistance Measurement	
General Information	Resistance measurement automatically switches between high and low range. Also featured is an audible beep that indicates continuity (defined as < 5Ω)
Measurement Range	0 – 4.9MΩ
Accuracy	±2% from 0 - 1MΩ ±10% from 1 – 4.9MΩ
Low Ohms Range Current Source	11mA
High Ohms Range Current Source	20μA
Diode Measurement	
Voltage Measurement Current Source	11mA

Maxim Voltage Drop	3.0V
Measurable Accuracy	±0.1%
DC Voltage Measurement	
Voltage Range	±40Volt
Measurement Accuracy	±0.1%
AC Voltage Measurement	
General Information	AutoTest measures AC Voltages by sampling input voltages at a frequency of 40kHz. The results are mathematically processed which results in true RMS AC measurements from 4Hz to the maximum 25kHz and for all input voltage waveforms
Voltage Range	±40Volts peak to peak
Frequency Range	From 1.0Hz to 25kHz
DC Current Measurement	
General Information	The current probe is a Hall effect type with dynamic cancellation of temperature offset errors. The current probe is sensitive to the Earth's magnet field and must be zeroed in accordance with the instructions in the User Manual to achieve the stated accuracy for low current measurement
Current Range	0 - 450 Amps
Accuracy	±0.05 Amps 0 – 2 Amps ±2.5% 2 – 450 Amps
Pulse Width and Duty Cycle Measurement	
General Information	Duty cycles and pulse widths are measured assuming an automotive solenoid switching system where the solenoid is "on" when switched to ground. As a result low voltage state is considered the positive pulse from which pulse width is measured and duty cycle is calculated
Pulse Width Range	0.1mS to 750mS
Accuracy	±0.1%

Battery Testing Specifications

General Information	AutoTest tests batteries using a unique pulsed impedance technique. It is designed to work with 12 Volt automotive batteries. AutoTest's pulsed impedance testing technique offers a unique testing feature; it can be used to test batteries while they are being charged. AutoTest circuitry is designed to handle the electrical loads caused by continuous battery testing as can be achieved when in the monitor screen of the SLV Test
Testable Battery Sizes	From 200 - 1000 SAE Cold Cranking Amps From 120 - 590 DIN From 25 - 140 Ah

Internal Battery Information

Type	Lead Acid Sealed VRLA
Voltage	6Volt nominal
Capacity	1.2Ah nominal
Charge Method	With Test Clips connected to a 12 Volt battery via built in internal charger

Data Storage and Communications

General Information	AutoTest can store managed test results in its non-volatile FLASH ROM memory. These results can be downloaded to a computer in a format that can be loaded directly into Excel®. AutoTest also has in its memory 80 column A4 size and 24 column 57.15 mm paper width preformatted test reports in each language that allow reports to be printed for an individual test or as a table summary of all the test results stored. Communication is via a PS2 mouse type sub miniature DIN plug at the base of the tester or via an in-built 940nm Infrared LED.
Test Results Stored	240
Report Format	80 column for large format printed reports (using the standard IBM character set) selectable between Epson and Hewlett Packard serial printing protocols 24 Column for thermal printer (57.15 mm paper width) Tab delimited text file for computer downloaded reports
Languages in which	English, German, French

Reports are Available	
Communications Protocol	RS232, 9600bps, 8 bit with 1 stop bit, no parity, Xon - Xoff flow control for serial printer Proprietary Hewlett Packard Infrared communications protocol used for printing to the HP82240B Thermal Infrared Printer via internal LED.

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12. Limited Warranty

This AutoTest is warranted to be free of defects in materials and workmanship for a period of one year from date of purchase. Eagle Trading Ltd will, at our option, repair or replace the unit with a remanufactured unit. This limited warranty applies only to the AutoTest Electrical Analyzer, and does not cover any other equipment, static damage, water damage, over voltage damage, dropping the unit, or damage resulting from extraneous causes including owner misuse. Eagle Trading Ltd is not liable for any incidental or consequential damages for breach of this warranty. The warranty is void if owner attempts to disassemble the unit or to modify the cable assembly.

13. Service

You must have the original purchase invoice for service. To obtain service, the purchaser should contact Eagle Trading Ltd for a Repair Request Form/Return Authorization number, and return the unit to Eagle Trading Ltd freight prepaid. Eagle Trading Ltd will service the analyzer and reship the next scheduled business day following receipt, using the same type carrier and service as received. If Eagle Trading Ltd determines that the failure was caused by misuse, alteration, accident, or abnormal condition of operation or handling, purchaser will be contacted prior to any repair and will be given an estimate of the repair cost. Upon repair approval, the purchaser will have to prepay the cost of repair. Once the unit repaired, it will be returned freight prepaid with freight charges previously added to the invoice. Battery analyzers beyond the warranty period are subject to the repair charges in effect at that time. Optional remanufacturing service is available to return the tester to like-new condition. Out-of-warranty repairs will carry a 3-month warranty. Remanufactured units purchased from Eagle Trading Ltd are covered by a 6-month warranty.

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